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A National Environmental/Energy Workforce Assessment. North Carolina

National Field Research Center, Inc, Iowa City, Iowa

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A National Environmental/Energy Workforce Assessment

NORTH CAROLINA

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16. ABSTRACT

This study is one of 70 volumes assessing the workforce needs (manpower needs) for pollution control and abatement in the United States for the five-year period of 1976 through 1981. Seven fields for pollution control — air, noise, pesticides, potable water, radiation, solid waste, and wastewater — are analyzed, together with energy-related programs currently accentuated by the national effort to solve energy supply problems.

Designed as Phase I of a three-phase program, the complete assessment includes the following volumes: one each for the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands; one for each of the ten EPA regions; a one-volume National Abstract; a volume on National Legislation; a volume on Business and Industry; and a four-volume National Summary. The information was gathered through extensive personal interviews with responsible federal, state, and local officials in every state; with officials of representative private industrial and commercial firms; and with representatives of national industrial and trade organizations.

Phase II will develop a broad national inventory of the entire range of post-secondary and higher education training offered in the pollution control and energy areas cited above, and Phase III will offer demonstrations for curriculum changes or modifications which appear necessary to assure an adequate and properly trained national environmental/energy workforce.

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Mr. Dayne Brown and Mr. W.J. Stevenson contributed by providing insights on the state's radiation control and solid waste management activities of the Department of Human Resources. Information concerning the state's pesticide regulatory program was provided by Mr. William Buffaloe of the Department of Agriculture. Although the state does not presently have a statewide noise pollution control program, information regarding current activities was contributed by Mr. Roy Paul of the Office of State Planning. Finally, Mr. Paul Hitchcock of the Department of Commerce provided valuable information on the state energy situation as director of the Energy Division.

PREFACE

This report presents existing workforce levels, training programs, and career potentials and develops staffing level projections (1976 to 1982) based upon available information for the State of North Carolina in the environmental pollution control areas of air, noise, potable water, pesticides, radiation, solid waste, wastewater, and energy. This study was carried out for the United States Environmental Protection Agency by National Field Research Center of Iowa City, Iowa.

The information and data presented in this report were compiled in large part from extensive interviews with professionals working in the respective areas and were supplemented by telephone surveys and research.

FOREWORD

The material herein contains the information collected for eight individual pollution control inventories conducted for North Carolina. The format includes workforce profiles, projections, growth and career potential for each of the areas investigated. Growth projections are necessarily best professional estimates developed from available information and represent what are felt to be realistic figures by experts in the respective areas. The pollution areas considered in this study are as follows:

Air

Noise

Pesticides

Potable Water

Radiation

Solid Waste

Wastewater

Energy

National Environmental Energy Workforce Assessment

Phase I

NORTH CAROLINA

State Summary

I. AIR

North Carolina's air pollution control program is located in the Board of Natural and Economic Resources and has a staff of 89. Little workforce growth is expected in the program, beyond the possible additions of several engineers, technicians, and a meteorologist. The current staff contains predominately engineers and technicians.

There are four federally-funded local air pollution control programs in the state, and five programs that are totally locally funded. These programs have a total staffing complement of 52 persons, chiefly engineers, scientists, technicians and sanitarians. Sources project that minimal workforce growth will occur in these programs.

State officials estimate that there are at least 500 environmental engineers employed in both the private and public sectors in the state to abate air pollution, who may be employed on either a full- or part-time basis. It is further estimated that there are 250 technicians, and that there may be over 1,000 persons of all backgrounds in the state working in the air pollution field.

It appears that the most likely career potential to develop in the air pollution field will be in the transportation area. Mechanics trained in the inspection and installation of pollution abatement devices in motor vehicles may be needed within five years. Personnel trained in modeling techniques and in the preparation of environmental impact studies will also be in demand, as will environmental economists.

II. NOISE

North Carolina does not currently have a noise pollution and abatement program at the state level. The State Legislature rejected a proposal for a noise program in 1973, which included a plan to provide technical assistance in noise pollution by hiring a person who was technically trained in acoustics. This person would have been available to various municipalities in North Carolina for monitoring and conducting noise surveys to identify problems. Until recently, there was one person in the Office of State Planning that worked half-time in noise, chiefly answering noise complaints. Functions have since been assigned to the Department for Natural Resources and Community Development. No persons have as yet been assigned for a noise control program.

There are few noise ordinances with acoustical criteria adopted by the state's municipalities. A Committee on Boundary Noise in 1973 developed model regulations for steady state noise at municipal boundaries.

With no state noise program in existence or planned, workforce projections are difficult to estimate. However, state officials feel that North Carolina is likely to begin a state noise program within five to ten years. The state's program would probably closely follow EPA guidelines and recommendations.

III. PESTICIDES

The North Carolina Department of Agriculture is the state's principal pesticide regulatory agency. The Department's Pest Control Division carries out the provisions of the North Carolina Pesticide Law of 1971. The Structural Pest Division administers the Structural Pest Control Act. The Food and Drug Protection Division of the Department analyzes residue formulations and other substances for cross-contamination. Within these agencies are 170 persons that work in the field on a full- or part-time basis. In addition, the North Carolina State University Extension Service has 100 extension service training agents who train commercial and private applicators. Staffing levels for state governmental personnel may not increase during the next five years, chiefly due to state budget restrictions. Needs for at least 9 additional positions have been voiced within the Pest Control Division. Most pesticide personnel in the public sector have degrees in agricultural fields.

State sources estimate that 60,000 private applicators will require certification as well as 1,229 commercial ground applicators, 126 commercial aerial applicators, 36 pest control consultants, and 1,641 pesticide dealers. The number of public operators, who apply pesticides for public agencies is estimated at 811. Officials expect a significant growth in the number of certified commercial applicators over the next five years and a growth in the number of public operators. The number of pest control consultants and dealers may remain stable, although the number of dealers may decline.

IV. POTABLE WATER

Water supply responsibilities in North Carolina are entrusted to the Department of Human Resources. The state has applied for assuming primacy of the Federal Safe Drinking Water Act. In order to do so, modification of North Carolina's General Statutes will be required.

Within the Water Supply Branch and the Engineering Planning Branch of the Department, approximately 40 persons service the potable water program, excluding technicians, who are expected to be phased out. This number may increase to 300 positions by 1982 if primacy is achieved. The Department's Environmental Sciences Laboratory has a staff of 19, which spends a portion of its time performing water supply analyses. This number is expected to increase to 44 by 1981.

There are currently 1,734 certified water treatment plant operators. All supplies must have a certified operator in charge by law. The number of operators is expected to substantially increase during the next five years, and these increases are expected for all four operator classifications.

The chief sources of training for plant personnel is the Annual Waterworks Operator School conducted by the North Carolina Waterworks Association. Training is offered for operators of all four classifications.

The Water Supply Branch and the Engineering Branch will hire primarily engineering personnel to carry out the federal Act. Chemists and laboratory technicians will be required in the Environmental Sciences Laboratory.

V. RADIATION

The Division of Facility Services of the North Carolina Department of Human Services is responsible for the state's radiation protection program. The Division's Radiation Protection Branch has four chief programs: X-ray Control, Radioactive Materials Control, Environmental Surveillance and Nuclear Facilities, and Administrative Assistance and Emergency Planning. There are 15 persons in the Branch: 4 health physicists, 2 engineers, 5 X-ray inspectors, 1 planner and 3 secretaries. Personnel of municipal health departments assist in collecting samples. Workforce growth is required, according to administrators, in order to carry out all required duties in the future. Projections include the addition of 13 personnel over the next five years.

State law requires that each user facility in the state have at least one person designated to fulfill radiation control functions, at least part-time. Sources estimate that there are 2,949 such persons in the state. Nuclear facilities in the state have from 35 to 45 radiation safety officers. State officials estimate that the nuclear industry will increase its radiation control staffing level by 10 to 30 over the next five years. No other workforce increases are expected to occur in the private sector.

Health physicists will probably continue to dominate the radiation control field, although increasing numbers of trained technicians may be used by nuclear facilities.

VI. SOLID WASTE

The Department of Human Resources is responsible for implementing North Carolina's solid waste program. This Department, through the Solid Waste and Vector Control Branch, will implement the Federal Resource Conservation and Recovery Act of 1976. The agency will devise plans for the management and disposal of hazardous wastes, and as a result of the new Act, is expected to double or triple its staff of 14 over the next five years. Local county health programs assists the Branch in carrying out a portion of its duties.

There are an estimated 600 landfill operators in the state. Weighmasters, mechanics, foremen, spotters and gatemen are employed only by the larger landfills. For resource recovery operations, the state has directed its efforts at encouraging private industries to invest in resource recovery facilities that could recover both commercial and industrial wastes. Legislation passed in 1976 authorizes the Department to certify facilities that are designed to recover resources.

It appears that career potentials in the solid waste field will dramatically improve as a result of the new federal legislation. The state plans to employ additional chemical engineers, chemists and sanitarians. The exact number of personnel required will be uncertain until a hazardous waste survey is completed and the state decides how deeply it will become involved in promoting resource recovery operations.

VII. WASTEWATER

The Division of Environmental Management of the North Carolina Department of Natural and Economic Resources exercises principal program responsibility for the state's wastewater control programs. The Division's Water Quality Section has a staff of 112 persons: 72 professionals, 24 technicians and 16 supportive personnel. Support for the wastewater program is also derived from the Division of Environmental Management's Enforcement, Laboratory, and Management Sections. The Water Quality Section's staffing level is expected to increase by 30 to 40 positions by 1982. Growth is also expected to occur in the other previously-mentioned sections.

State law requires that each wastewater treatment plant have at least one certified operator in charge. There are currently 1,778 active certificates issued to plant operators. The Division of Environmental Management has estimated that there are currently at least 2,000 operators requiring training and approximately 3,000 additional operators that will require certification and training by 1980.

Sources of training available to operators include Regional Schools, Laboratory Training Schools, Annual Schools, and Advanced Wastewater Treatment Seminars. A survey of wastewater treatment plant operators has revealed that operators feel a number of training needs are not being met. The overall training program will be expanded during Fiscal Years 1977 and 1978.

VIII. ENERGY

The South Carolina Department of Military Affairs housed the Energy Division, the state's energy agency until recently, when it was transferred to the Department of Commerce. The Division was created to carry out operational and planning aspects of energy management and to implement energy policies. The Division is currently concerned with energy allocation, and plans to implement a conservation program under the Federal Energy Policy and Conservation Act. The agency employs 11 people, and moderate workforce growth is expected.

The state's two chief utilities, Duke Power Company and Carolina Power and Light Company employ personnel on staff to abate and control pollution. Data indicates that little environmental staff growth will be required over the next five years. Since most plants planned for construction will be nuclear plants, demands may increase for radiation control personnel.

Energy Division officials expect a great shift towards the usage of coal and solar power sources. Private concerns are becoming involved in commercially constructing solar reflectors, and the Energy Research and Development Administration has chosen a North Carolina site as a possible location for an installation creating energy from wind power. Career opportunities may increase in the field of the development of alternate energy sources.

STATE OF NORTH CAROLINA - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR [1]	141	141	142	144	145	146	1%
NOISE [2]	1	0					n/a
PESTICIDES [3]	169	169	178	178	178	178	1%
POTABLE WATER [4]	1,795	2,055	2,243	2,499	2,712	2,926	10%
RADIATION [5]	15	21	21	28	28	28	12%
SOLID WASTE [6]	14	22	30	36	38	41	25%
WASTEWATER [7]	1,890	2,500	3,097	3,867	4,623	5,221	23%
ENERGY [8]	11	19	20	21	22	23	19%
TOTALS	4,036	4,927	5,731	6,773	7,746	8,563	16%

[1] Includes the state and local programs. It is estimated that at least 1,000 people totally work in the field. Figures do not include Research Triangle Park.

[2] Although there currently is no noise program, if noise legislation is passed, the workforce would necessarily increase.

[3] Includes the Department of Agriculture & the Cooperative Extension Service. Not included are approx. 60,000 private applicators, 1,355 commercial applicators, 36 consultants, 641 dealers & 811 public operators. The number of commercial applicators may increase; the other groups may remain stable.

[4] Includes the state agency (1976=59;1981=298) and certified water plant operators.

[5] Includes the state agency but does not include the some 3,600 designated radiation safety officers of the state's radiation using facilities.

[6] Includes the state agency. The number of landfill operators is approximately 600.

[7] Includes the state agency (1976=112;1981=147) and certified wastewater plant operators.

[8] Includes the state lead energy agency.

EDUCATION

There are many educational institutions ranging from university to community college levels in North Carolina that provide environmental curricula. Among the outstanding programs are the Universities of North Carolina at Chapel Hill, Charlotte, and Wilmington. Degrees at the bachelor, master's and doctorate levels in environmental programs at Chapel Hill and bachelor level programs at Charlotte and Wilmington are available. Duke University offers two graduate level programs in Civil Engineering and Environmental Management. North Carolina State University awards graduate degrees in Nuclear Engineering as well as Civil Engineering. East Carolina University offers an Environmental Health curriculum at the undergraduate level. Environmental Studies programs are available at St. Andrews Presbyterian College, Pfeiffer College, and Lenoir-Rhyne College.

Other notable programs include the Air and Water Resource Technology program at Pitt Technical Institute, Environmental Science Technology at Wilkes Community College and Martin Community College, and Environmental Engineering Technology and Water and Wastewater Plant Operators curricula at Fayetteville Technical Institute. Western Piedmont Community College provides a certificate program for Wastewater Treatment Operators. Wilson County Technical Institute offers a Sanitary Landfill Operator-Manager option curriculum. Shaw University offers a curriculum in Environmental Science. Durham College provides a program in Environmental Health Sciences.

LEGISLATION

The environmental/energy legislation for North Carolina was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Environmental Policy Act

Water and Air Resources Act

Water and Air Quality Reporting Act

Pesticide Law of 1971

Water and Sewer Sanitation Law

Radiation Protection Act

Solid Waste Disposal Law

Oil Pollution Control Act of 1973

Sanitarians and Water and Waste Water Treatment Facility Operators Law

National Environmental Energy Workforce Assessment

Phase I

NORTH CAROLINA

State Report

13

STATE PROFILE

North Carolina ranks eleventh in the nation in population and twenty-ninth in size. The state is a major producer of furniture, brick, tobacco and textiles. North Carolina ranks second in the Southeast in population and its industrial and agricultural products give it first place in terms of value in the region. Nearly one-half of the state's manufacturing workers are employed in the apparel, textile and other similar industries. Nearly one out of ten North Carolina residents are employed by the furniture and home furnishing industries.

Other major industries in North Carolina which makes for a diversity in variety of production in the state are the chemicals, metalworking and paper industries. North Carolina is also the United State's number one producer of mica and lithium. Important agricultural products include tobacco, corn, hay, peanuts, cotton and vegetable crops.

The Atlanta Journal (January 9, 1977) quoted former Governor James E. Holshouser as stating that for the first time ever, the state attracted over $1 billion worth of new industry in 1976. In the four years he was Governor, (until this year) this created over 41,000 new jobs for the state. For the first time, the textile industry was not among the top five in the state in investment of new and expanded facilities in 1976 and did not rank among the top four industries in the state in the number of new jobs created.

NORTH CAROLINA POLLUTION CONTROL AND ABATEMENT AGENCIES

The North Carolina Department of Natural and Economic Resources and the Department of Human Resources are the principal state environmental agencies. The Department of Natural and Economic Resources has primary responsibilities for the air and wastewater programs. The Department of Human Resources has principal responsibility for the potable water, radiation and solid waste programs.

In the Department of Natural and Economic Resources, the pollution control activities are located under the Division of Environmental Management. This Division has six sections: Planning and Management, Water Quality, Groundwater, Air Quality, Laboratory, and Enforcement.

The Planning and Management Section is responsible for water planning, data management and management and budget. The Water Quality Section is responsible for municipal facilities construction, permits and engineering, operator training and certification, water quality operations and the USGS Cooperative programs. The Division's Groundwater Section conducts monitoring regulation and enforcement and hydrogeological research and investigations. Field operations, plan review and technical review are among the responsibilities of the Air Quality Section. The Laboratory Section is composed of a central laboratory and regional laboratories. The Division's Laboratory Section conducts analyses of air quality and wastewater samples. This section also conducts a laboratory certification program, special studies, prepares reports and provides training. The Enforcement Section enforces rules and regulations and standards, prepares orders, decisions, agreements, legal procedures, public notices and provides regional enforcement advice.

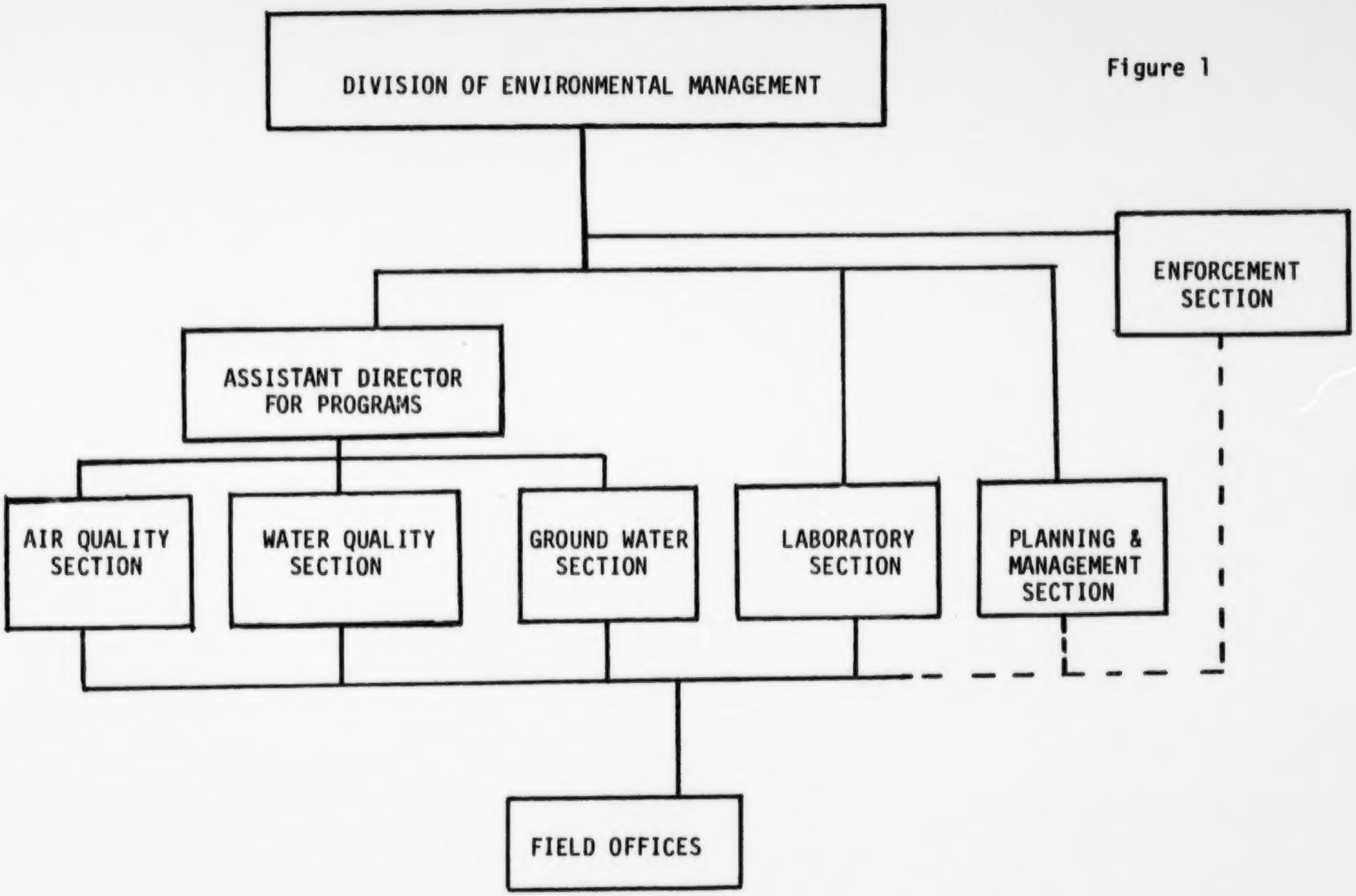
The Environmental Management Commission and its Air and Water Quality Councils provide policy making functions for the Division of Environmental Management. Finally, the Wastewater Treatment and Plant Operators Commission of Certification is also a part of the Department of Natural and Economic Resources.

In the Department of Human Resources, the pollution control activities are located in the Division of Facility Services and the Division of Health Services. The Radiation Protection Branch is a part of the Division of Facility Services, whereas the Solid Waste and Vector Control Branch and the Water Supply Branch are located in the Division of Health Services.

The state lead agency for the pesticide applicator certification program is the Department of Agriculture. The Pest Control Division has a Pesticide staff which is responsible for regulating restricted use pesticides. The Structural Pest Control Division is responsible for regulating the usage of structural pesticides.

Energy planning and development for the State is carried out by the Energy Division in the North Carolina Department of Commerce. The Energy Division prepares an emergency petroleum allocation plan for the state and conducts energy conservation planning.

Figure 1


DIVISION OF ENVIRONMENTAL MANAGEMENT
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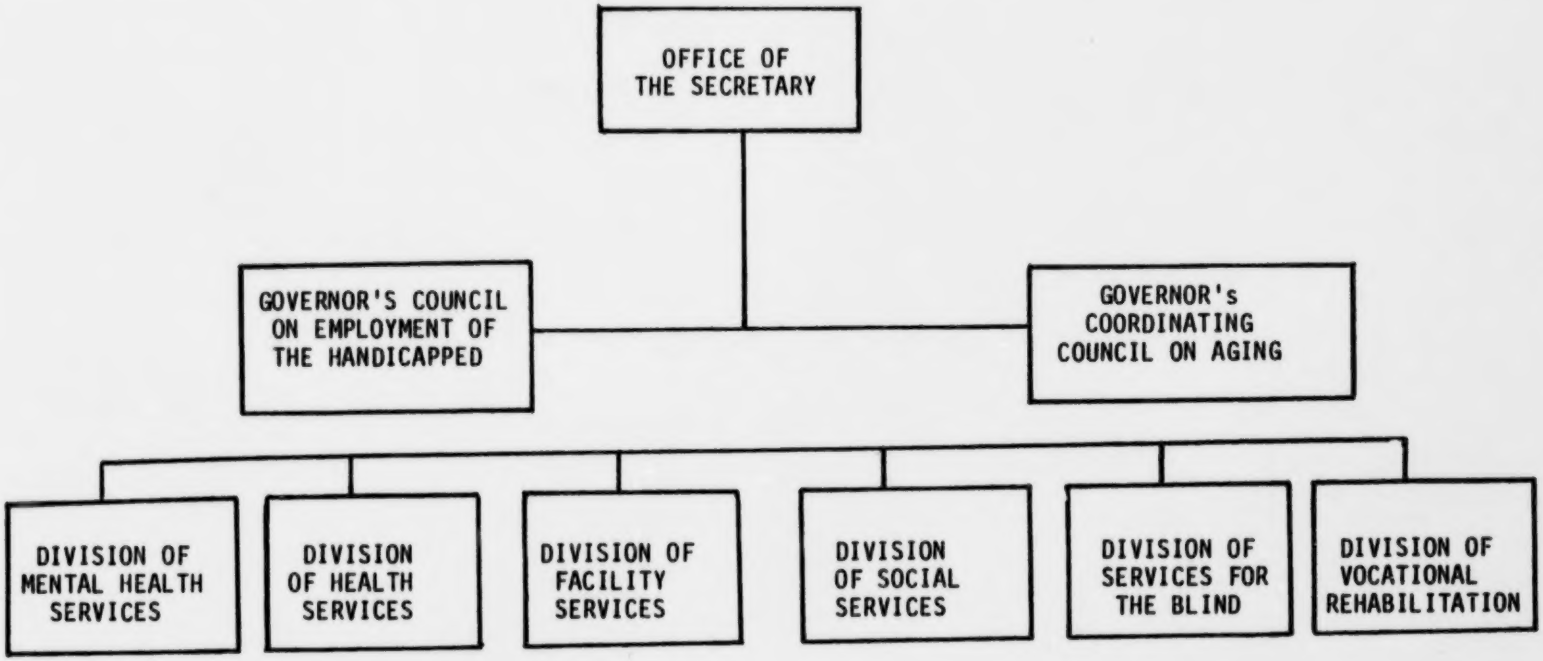
WATER QUALITY SECTION
GROUND WATER SECTION
LABORATORY SECTION
PLANNING & MANAGEMENT SECTION
FIELD OFFICES

North Carolina Department of Natural and Economic Resources

Division of Environmental Management

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES

Figure 2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DIVISION OF FACILITY SERVICES
DIVISION OF SOCIAL SERVICES
DIVISION OF SERVICES FOR THE BLIND
DIVISION OF VOCATIONAL REHABILITATION

Pollution Control and Abatement Programs

I. AIR

A. Introduction

The State of North Carolina's air pollution control and abatement program is located under the Board of Natural and Economic Resources. The Environmental Management Commission controls program policy of the air program for the Board. The Air Quality Council provides technical advice to the Commission so that it can make informed judgements.

The North Carolina air program is operationally located in the Division of Environmental Management which is under the Department of Natural and Economic Resources. This Division was created under a reorganization in July 1974.

The purpose of the Division of Environmental Management's program is to "achieve and maintain for the citizens of North Carolina a total environment of superior quality and secure for the people the beneficial uses of water, air and integrally-related natural resources."

The Air Quality Section is supported by the Enforcement, Laboratory, Planning and Management sections, and parts of the Division of Environmental Management. The Air and Water Quality sections have seven field offices. The Laboratory section has regional laboratories at the Department's field offices in Asheville, Monroeville and Washington. The Division's main office in Raleigh handles administration, operator training, permit coordination, formal enforcement, plans review and planning functions. The field offices handle surveillance, investigations, network monitoring, informal enforcement and technical assistance for the Division.

Ambient Air Quality Standards were adopted by the Environmental Management Commission for the State of North Carolina based on the Federal Primary and Secondary Ambient Air Quality Standards. The Primary National Ambient Air Quality Standards have already been attained in the State of North Carolina. The Secondary Standards for some criteria pollutants have not been obtained as of yet. For the next five year period it is projected by state officials that air quality impact analyses and projections of future air quality levels will be conducted very extensively.

It is anticipated that the issuance of emission control orders should decline in frequency over the next five years. During the FY 1977-1979 biennium, the attainment of compliance through the issuance of orders to sources of pollutants so as to effect compliance with emission limitations will have been accomplished. Future activity in this area will then be primarily directed to the control of new sources and the reissuance of existing permits and maintenance and inspection of existing sources.

State officials consider the current levels of monitoring of ambient air quality on a statewide basis to be adequate for the next five years. The state will emphasize the proper location of monitoring sites to reflect areawide ambient air quality patterns. To support studies in problem areas, additional ambient air quality data will be required. Although the resources available to conduct source testing are considered inadequate, current levels of activity in this area are projected to continue at the present level over the next five-year period. A much expanded source testing capability in the future will be needed to predict future levels of air quality through modeling and to assure compliance with emission standards.

Enforcement activities are expected to continue near existing levels. There may be some increase in enforcement activities because of an expanded emphasis in source testing.

Adequate staff training in all general areas of pollution control and in modeling techniques is considered by state officials to be necessary in order to maintain a high quality air pollution program. State officials also consider training for state and local governmental employees in visible emission evaluations on an ongoing basis essential to their air quality program's success. They project that training levels for these activities over the next five years will continue at the existing level.

There are four fully EPA funded local air programs in North Carolina. These local air programs are fully certified by the state and consist of the following:

1) Mecklenberg County,
2) Forsyth County,
3) Western North Carolina,
4) Gaston County.

Any increases in the staffs of these programs are dependent on what new federal pollution control programs are implemented. All of these programs are certified by the state but at different levels. They have full jurisdiction within their counties and operate just as the state would in carrying out their functions. Sources in the field foresee minimal changes in their programs in the years up to 1982 in terms of workforce.

There are also five partial local air programs in North Carolina which have left their permitting-engineering functions to the state agency to perform. These programs are totally county-funded. These county health departments were not willing to employ engineering services or review personnel which were being required by EPA as a condition for federal funding. They perform certification, monitoring, technical and enforcement services, but leave engineering services to the Division of Environmental Management.

The county health department pollution control and abatement activities are a joint effort with the State Air Quality Agency depending upon the services needed. Sources in the field project no increase in their program effort for the next five-year period basically because they receive no federal funds and do not hire engineers.

B. Workforce Profile

The Division of Environmental Management has personnel in administration, enforcement and laboratory sub-programs who devote a portion of their time to air pollution control and abatement activities. The principal sub-program directly concerned with air pollution control and abatement is the Air Quality Section.

The basic purpose of the Air Quality Sub-Program within the Division of Environmental Management is to "attain and maintain air quality equal to the primary and secondary National Ambient Air Quality Standards, and preserve the quality of presently clean air through development and implementation of a realistic 'Prevention of Significant Deterioration Program'".

The Air Quality Section is subdivided into two basic branches: Field Operations and Permits, and Technical Services. The Field Operations and Permits Branch has jurisdiction over Plans Review and the Air Quality Section's activities at the Department's seven field offices. These field offices include:

1) Asheville,
2) Fayetteville,
3) Morresville,
4) Raleigh,
5) Washington,
6) Wilmington,
7) Winston-Salem.

The Technical Services Branch has two subdivisions: Analysis and Review, and Monitoring. The Analysis and Review Sub-branch has a coordinating function with the four local programs to which the state provides technical engineering services. The Monitoring Sub-branch conducts source testing activities.

The program objectives of the Air Quality Section include the following which are to be accomplished over the next several years:

1) To "achieve, statewide, a level of air quality, as measured at the 140 ambient air quality monitoring stations, equal to or better than National Primary Ambient Air Quality Standards."

2) In North Carolina, there are 887 known major air pollution sources. According to the following schedule, the state plans to achieve compliance with emission limitations contained in the state plans to achieve compliance with emission limitations contained in the State Implementation Plan. There are 91 sources at present not in compliance with emission limitations and 74 of these are scheduled to be in compliance during FY 1976-1977, 11 during FY 1978-1979.

3) There are 9,360 minor sources of air pollution known in the state. The Division has scheduled in the State Implementation Plan for these sources of air pollution to achieve compliance with emission limitations according to the following schedule. At the present time there are 34 known minor sources of air pollution not in compliance with emission limitations. Twenty-three of these sources are scheduled to be in compliance during FY 1976-1977, 11 in FY 1977-1978 and no sources during FY 1978-1979.

4) The last major objective of the Air Program in North Carolina is to "prepare a 'No Significant Deterioration' policy for adoption by the Environmental Management Commission and implement the adopted policy during FY 1976-1977, FY 1977-1978, and FY 1978-1979.

The Air Quality Section has the services of 89 persons in the Division of Environmental Management. The Section itself has 77 positions with three laboratory chemists and seven field office secretaries bringing the total to 87 total staff directly assigned to the Air Quality Section. Two Data Communications staff working on Air Quality Section matters bring the total to 89 positions.

The Air Quality Section is staffed with 44 professionals, 30 technicians and 15 clerical positions. The 44 professional positions include environmental engineers, an environmental research specialist, chemical consultants, a meteorologist, laboratory chemists, and a data communications specialist.

The 30 "technical" positions include environmental engineer technicians, electrical technicians, and monitoring technicians. The 15 "other" positions include secretaries, clerk-stenographers, clerks and a data clerk. The current staffing level by profession is depicted in the following table.

TABLE I

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION

Air Quality Section
Current (1976) Staffing Level

Position	1976
Engineer	34
Attorney	0
Meteorologist	1
Research Scientist	8
Technician	30
Trainee/Aide	0
Other	16
TOTAL	89

The nine local air pollution control programs have a total staffing complement of 52 persons. The positions represented in these programs are shown in the following table.

TABLE II

MUNICIPAL AIR POLLUTION CONTROL PROGRAMS

Current (1976) Staffing Level

Position	1976
Engineer	11
Attorney	1
Scientist	9
Technician	11
Sanitarian	6
Other	14
TOTAL	52

State officials estimate that there are at least 500 environmental engineers employed in both the private and public sectors in North

Carolina to abate air pollution. In the private sector, these engineering personnel may be employed on either a full or part-time basis to control air pollution. Sources in the field estimate that the private sector may employ an additional 250 technicians to control and abate air pollution. In sum, excluding the EPA Research Triangle Park area, there may be over 1,000 persons involved in North Carolina's effort to control air pollution.

C. Workforce Projections

Workforce projections regarding the state and municipal air quality control programs are based upon the best professional judgement of persons involved in the state air program.

Little growth is expected for the Air Quality Section over the next five years as program officials feel that their present staffing complement is adequate to perform their basic mission. If any increase occurs in staff, only several engineers, technicians and a meteorologist may be hired by the Air Quality Section. Staffing projections for the next five years for the Air Quality Section are shown in the following table.

TABLE III

NORTH CAROLINA DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES

Division of Environmental Management
Air Quality Section
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	34	34	34	35	35	36	3%	1%
Scientist	9	9	9	10	10	10	3%	2%
Technician	30	30	31	31	32	32	5%	1%
Other	16	16	16	16	16	16	4%	0
TOTAL	89	89	90	92	93	94	4%	1%

Turnover averages three to five percent for the Air Quality Section. In the last two years, five professionals were recruited by the private sector from the Air Quality Section. Turnover among the monitoring technician positions is greater than among engineering technicians because of salary differences. Program officials project that personnel changes will probably result in replacing personnel lost through turnover. There is also very little or no growth expected by state officials in the staffing complements of the municipal air pollution control programs over the next five years.

D. Training and Certification

The Air Quality Section's staff professionals participate in interdivisional training programs and attend courses offered by the Air Pollution Training Institute in North Carolina. Program officials consider their professional staff to be among the best trained in the nation. The Air Quality Section has a major advantage in its close proximity to the EPA Air Pollution Training Institute in Research Triangle Park. Staff, when first recruited, participate in a thirty-day training program offered by the Division of Environmental Management for its employees. The program is oriented to familiarize staff with:

1) General statutes;
2) Rules and regulations governing the control of air pollution;
3) Administrative procedures;
4) Department and Division organization;
5) Methods and procedures in monitoring;

6) Abatement and control; and

7) Division policies.

Staff also attend annual Division staff conferences to discuss future activities, new regulations and policies of the Department of Natural Resources and Environmental Protection. Staff also attend environmental workshops offered by such organizations as the Air Pollution Control Association.

North Carolina sent a total of 134 persons to EPA Air Pollution Training Institute courses in 1976. The Institute's tuition requirement has made it more difficult for Division personnel to attend its courses. State officials maintain that if the Institute continues to charge tuition fees, the Air Quality Section may be compelled to establish its own in-house training program.

North Carolina's visible emission certification program is designed to make available to industry, commerce, government agencies and the general public, a form of training which will assist them in complying with visible emission regulations. Also, it is to certify regulatory and law enforcement personnel in procedures and methods of visible emission evaluation. The state requires that persons attending the visible emission evaluation for certification for the first time attend both the lecture and field evaluation portions of the program. Those attending for recertification are only required to attend the field evaluation. Evaluations are held in seven regions in the state every six months. "Smoke readers" are required to be recertified every six months. Approximately 250 people attended visible emission evaluations in 1976. The state also certifies Department of Transportation personnel who work at weigh stations, 1,200 highway patrolmen, and new trainees at the Department of Transportation's own visible emission schools. Private industry usually sends boiler room personnel, chief engineers and others to state-sponsored "smoke schools". The state's visible emission evaluation training program is considered to be adequate by program officials for the next five-year period.

E. Career Potential

Little workforce growth is likely to occur over the next five years in air pollution control in the public and private sectors. It appears that the most likely career potential to develop in the air pollution control field exists in the transportation area. State officials project that mechanics trained in the inspection and installation of pollution abatement devices in motor vehicles will be needed in the environmental transportation field in the next five years. Other personnel trained in modeling techniques and in the preparation of environmental impact studies will likely be needed by both the public and private sectors. Environmental economists may be needed by pollution control and abatement regulatory agencies to conduct cost-effectiveness analyses based on data developed through conducting environmental impact and modeling studies.

F. Conclusion

Little growth is projected for both the state and local air pollution regulatory programs in North Carolina by state or local officials. Budgetary constraints and the completion of growth phases are the principal reasons little further growth in the number of air pollution control jobs is anticipated by 1982. Any further growth by regulatory agencies is dependent on whether new regulations promulgated by EPA require further tasks to be performed by regulatory agencies.

The tight job market has enabled the Division of Environmental Management to recruit more highly trained professionals than was possible in the past.

The tuition charged by the EPA Air Pollution Training Institute will compel the state agency to utilize this training institute less frequently. The Division's Air Quality Section may initiate an in-house training program to fill the training gap. The Section's professionals have already met most of their training needs by attending Air Pollution Training Institute courses.

Private industry in North Carolina is in the final stages of installing control technology to abate air pollution. Additional technicians or engineers may be needed who are trained in "smoke reading" and can perform continuous monitoring tasks to ensure that there is no significant deterioration in the ambient air quality standards already attained.

II. NOISE

A. Introduction

North Carolina currently does not have a noise pollution and abatement program at the state level. The State Legislature rejected a proposal for a noise program in 1973, which included a plan to provide technical assistance in monitoring noise pollution by hiring a person who was technically trained in acoustics. This person would have been available to various municipalities in North Carolina for monitoring and conducting noise surveys to identify noise problems. There are few noise ordinances "on the books" in North Carolina's municipalities, according to Mr. Roy Paul, an environmental planner who has been designated as North Carolina's official noise contact for the Environmental Protection Agency.

Active citizen groups in North Carolina, mainly composed of lawyers, are distressed about the inaction concerning efforts in the control of noise pollution and would actively support noise legislation. At the current time no monies are appropriated for noise control by the Legislature. However, the Department of Transportation performs noise impact analyses concerning traffic noise problems.

Dr. L. H. Royster, the associate director of the Center for Acoustical Studies at North Carolina State University, was appointed chairperson of the North Carolina Department of Administration's Committee on Community Noise Regulations. Dr. Royster was active in bringing the proposed noise legislation before the legislature in 1973. According to Dr. Royster, the bill was not passed at that time because the timing was wrong and support was lacking from citizens and community groups. North Carolina does not currently deal with noise pollution, and there is no longer a committee that studies the noise pollution problem.

There are no longer any hearings being conducted in North Carolina regarding noise pollution. Local hearings were held recently to discuss a controversial airport expansion plan in the Research Triangle Park area; however, the expansion budget plan was tabled, according to Mr. Paul, because representatives believed that aspects of the plan would provide an impetus for the implementation of a noise pollution abatement program that would lead to the widespread regulation of noise in North Carolina.

B. Workforce Profile

Mr. Paul is located in the Office of State Planning and approximately 50 percent of his time is dedicated to noise problems. His functions as the official noise contact include receiving letters from EPA concerning noise and responding to inquiries about noise pollution problems from the public. Mr. Paul also informs the public about general nuisance ordinances and recommends programs that municipalities can adopt, such as establishing public boundaries for non-mobile stationary sources of noise. He feels that noise pollution is widely regarded as a tertiary problem in North Carolina.

Mr. Paul has recommended a noise program for municipalities but few have been implemented to date. There are few noise ordinances adopted by the state's municipalities because there are no objective standards in the laws or regulations to be met. Mr. Paul served on a Committee of Boundary

Noise composed of seven North Carolina residents appointed by the North Carolina Department of Administration in 1973. Technical assistance was provided for this study by the Center for Acoustical Studies at North Carolina State University. The Committee was given the task of developing model regulations for steady state noise at municipality boundaries. A study of the problems resulting from noise exposure was conducted, including permanent and temporary hearing loss, interference with speech communications, annoyance, and general effects on health. A parallel study of existing municipal and county ordinances and community problems resulting from noise emission was carried out. The findings of these studies led to the development of boundary noise criteria for residential-residential boundaries, industrial-residential boundaries, and industrial-industrial boundaries.

The source for the preceding data was the report published by the Committee on Boundary Noise in September 1973, entitled The Regulation of Steady-State Noise Sources at Boundaries in Municipalities of North Carolina.

Dr. Clifford R. Bragdon, a contributing editor to the Sound and Vibration Magazine, listed in his article entitled "Municipal Noise Ordinances - 1975" 55 municipalities in the state that have some type of noise ordinances, but only Chapel Hill has a nuisance ordinance that includes acoustical criteria. Chapel Hill, Tarboro and Winston-Salem have zoning ordinances that include acoustical criteria. Chapel Hill, Durham, Fayetteville, Greensboro, New Bern, and Raleigh have vehicle ordinances, but only Winston-Salem has one which includes acoustical criteria. In the construction noise ordinance category, only Chapel Hill, Durham and Fayetteville have construction noise ordinance but acoustical criteria are not included.

C. Workforce Projections

With no state noise program in existence or planned, workforce projections are difficult to estimate. However, state officials feel that North Carolina is likely to begin a state noise program within five to ten years. Mr. Paul feels that the state would probably closely follow EPA guidelines in the development of a North Carolina statewide noise control program.

D. Training and Certification

The best available training for noise pollution control in North Carolina is offered at the Center for Acoustical Studies at North Carolina State University in Raleigh.

E. Career Potential

Because North Carolina does not have a state noise program, future career potential is impossible to determine. Numbers and types of careers are contingent on program development.

F. Conclusion

North Carolina does not have a state noise program at the present time although such a program is likely to be created within the next five to ten years according to state sources. There are no committees or hearings being conducted in North Carolina to study the noise problem at this time. The Center for Acoustical Studies in North Carolina is recognized as a leader in the field of acoustical engineering.

Note: Subsequent to the writing of this report, the noise program was transferred to the Department of Natural Resources and Community Development, Office of the Deputy Secretary. As of May 31, 1977, no personnel had been assigned to the program. Officials in the Department have expressed the belief that there will be a fullfledged noise program developed within the next five years as the citizenry and the General Assembly become more aware of the need.

III. PESTICIDES

A. Introduction

The North Carolina Pesticide Law of 1971 is the State of North Carolina's principal pesticide registration, sale and use law. This Law was primarily enacted to provide for the regulation of the use, application, sale and disposal of pesticides in the state. The Structural Pest Control Act of North Carolina of 1955 as amended by House Bill No. 64 in 1977 provides that it is unlawful to engage or supervise work in structural pest control unless licensed or certified by the Structural Pest Control Committee. As a registration law, the North Carolina Pesticide Law states that it is unlawful to distribute, sell, or transport in intrastate commerce, pesticides not registered with the Pesticides Board. It also makes it unlawful to engage in business of marketing restricted-use pesticides as a pesticide dealer unless licensed by the Pesticide Board. Further, the law provides that it is unlawful to engage in the business as a commercial pesticide applicator or to perform services as a pest control consultant, unless licensed by the Pesticide Board, or to use any pesticide in a manner inconsistent with its label.

The 1971 Pesticide Law designated the Pesticide Board and the Commissioner of Agriculture responsible for carrying out the provisions of the article. The North Carolina Pesticide Board is composed of seven members appointed by the Governor, and includes representatives of the Department of Agriculture, the Department of Human Resources, and a State Conservation Agency. Other members include a representative of the agricultural chemical industry, a person directly engaged in agricultural production and two at-large members. One of the members-at-large is to be a non-governmental conservationist, and both cannot be from the agricultural chemical industry or directly engaged in agricultural production. The Pesticide Board functions as the governing authority for the State's pesticide management programs, and has the authority to adopt rules and regulations and to make policies for such pesticide programs. A Pesticide Advisory Committee was also established to assist the Board and the Commissioner of Agriculture in an advisory capacity, and consists of seventeen members, all of whom are appointed by the Board. The Pesticide staff, which is a part of the Pest Control Division within the North Carolina Department of Agriculture, administers the Pesticide Board's rules, regulations and policies.

B. Workforce Profile

The Pest Control Division consists of a Pesticides Staff, a Plant Protection Staff, and three district offices. The Division's main office is located in Raleigh with the district offices located in Greenville, Raleigh, and Asheville. Formerly operating as a section of the Pest Control Division, the Structural Pest Control Division, with the assistance of a five-member Structural Pest Control Committee is responsible for administering the provisions of the Structural Pest Control Act.

Seven analytical chemists and one laboratory helper, working in the Food and Drug Protection Division of the North Carolina Department of Agriculture, are supported by the Pest Control Division and are available to analyze pesticide samples for residue, cross-contamination, and to ensure conformance with label ingredients and claims. Microbiology samples are also analyzed for conformance with label claims.

The Director of the Pest Control Division is also the State Entomologist. He allocates 50 percent of his time to pesticide programs and is assisted in this effort by an administrative assistant and a clerk-stenographer.

The Pesticide Staff is headed by an administrator, who is assisted by four pesticide specialists, a data coordinator, a secretary, three clerk-stenographers, a clerk-typist and a keypunch operator. Field personnel include two pest control inspectors, one district supervisor and one clerk-stenographer located in the Western District; five pest control inspectors, one district supervisor and one clerk-stenographer located in the Central District; three pest control inspectors, one district supervisor and one clerk-stenographer located in the Eastern District.

The Plant Protection Staff is headed by an administrator, who is assisted by a biological officer, a plant pathologist, a greenhouse manager, an entomologist, an agricultural research technician and two clerk-stenographers. Field personnel include two apiary inspectors with headquarters in Red Springs and Rutherfordton; two pest control specialists, two pest control inspectors, one district supervisor and one clerk-stenographer located in the Western District; three district specialists, two pest control inspectors, one district supervisor and one clerk-stenographer, located in the Central District; three pest control specialists, three pest control inspectors, one district supervisor and one clerk-stenographer, located in the Eastern District.

The Structural Pest Control Division includes a director, two structural pest control supervisors, six structural pest control inspectors and three clerk-stenographers.

The North Carolina State University Extension Service has one hundred extension service training agents who train commercial and private applicators in North Carolina's one hundred counties. A four-hour course in the proper application of restricted-use pesticides is one of the certification options offered to private applicators.

The North Carolina Pesticide Board's Regulation 2 NCAC 10D .0605 requires that "public operators", or persons in governmental units or agencies listed in the regulation, be licensed. A public operator in North Carolina is any person in charge of any equipment used by public utilities, state agencies, municipal corporations or other government agencies applying pesticides. Eight hundred and eleven public operators were licensed in 1976, from such agencies as the Department of Transportation, the U.S. Department of Agriculture, the North Carolina Department of Agriculture, the North Carolina Department of Natural and Economic Resources, and the North Carolina Department of Human Resources. In addition, specified personnel from county boards of health and municipal governments are required to be licensed. The Solid Waste and Vector Control Division in the Sanitary Engineering Section of the Department of Human Resources has a district sanitarian for its vector control program and an environmental engineer in charge of the salt marsh mosquito program. It is estimated by the pesticide staff officials that approximately 200 persons working in county health departments are licensed as public operators.

As of December 31, 1976, there were 1,229 persons with certificates for ground application and 126 persons with certificates for aerial application. As many persons become certified in more than one category, the number of certificates issued by that date is higher. The following depicts the commercial categories utilized and the number of certificates issued on that date:

Category	Number
I. Pesticide applicators and public operators utilizing ground equipment	
A. Agricultural Pest Control	
Plant (four subcategories)	750
Animal	274
B. Forest Pest Control	313
C. Ornamental and Turf Pest Control	970
D. Aquatic Pest Control	269
E. Right-of-Way Pest Control	183
F. Public Health Pest Control	250
G. Regulatory Pest Control	111
H. Demonstration Pest Control	254
I. Seed Treatment Pest Control	18
II. Pesticide applicators and public operators utilizing aerial equipment (certified in same classifications as above but specific classification numbers are not available)	126
TOTAL	3,518

The following table depicts total numbers of persons estimated to be currently in the pesticide workforce, according to estimates provided by Pesticide Staff officials.

TABLE IV

Current (1976) North Carolina Pesticides Staffing Levels for both the Public and the Private Sectors

Public Sector	1976
North Carolina Department of Agriculture:	
Pest Control Division	51
Structural Pest Control Division	12
Food and Drug Protection Division	7
Cooperative Extension Service	100
North Carolina Department of Transportation:	
Division of Highway Landscape Unit	14
U.S. Department of Agriculture:	
Plant Protection Quarantine Program	n/a
North Carolina Department of Natural and Economic Resources:	n/a
Office of Forest Resources	
Pest Control Unit	
Nursery Unit	
Tree Improvement Unit	
Forestation Unit	
North Carolina Department of Human Resources:	
Solid Waste and Vector Control Branch	2
County Boards of Health and Municipal Governments	200
TOTAL	1,000 (est.)

Private Sector	1976
Private applicators	60,000
Commercial ground applicators	1,229
Commercial aerial applicators	126
Pest control consultants	36
Pesticide dealers	1,641
TOTAL	63,032

Pesticide dealers, pesticide applicators and pest control consultants are required by the Pesticide Law of 1971 to pass a written examination in order to become licensed. In North Carolina, according to the Pesticide Law, a pesticide dealer is any person who is engaged in the business of distributing, selling, offering for sale, or holding for sale restricted-use pesticides for distribution directly to users. A pesticide applicator is any person who owns or manages a pesticide application business of applying pesticides upon the lands or properties of another. A pesticide applicator is also any person engaged in demonstration or research pest control. Regulations of the Pesticide Board state that the Commissioner of Agriculture must license at least one person at each business location, who must be responsible for the application of pesticides for routine pest control situations. The person licensed as the pesticide applicator, if not directly involved in the use of pesticides, must supervise and guide the activities of all personnel applying pesticides from the business location of the licensee. A pest control consultant in North Carolina is any person who, for a fee, offers or supplies technical advice, supervision, or aid, or recommends the use of specific pesticides for the purpose of controlling insects, plant diseases, or weeds, and other pests, but does not include any person regulated by the Structural Pest Control Act.

C. Workforce Projections

Staffing levels for state government personnel may not increase dramatically during the next five years, according to pesticide program administrators. The chief reason for this projection is that the State Legislature is not currently considered amenable to further budgetary or staff increases. The Pesticide staff experiences a very low annual turnover rate, annually averaging about eight percent, or one inspector per year.

Program officials project that the most possible increase in staffing level to occur in the next five years would come from the next biennium budget (Fiscal Year 1977-1978). The North Carolina General Assembly meets in regular session biennially, and the Pesticide staff is asking the General Assembly for approval and an appropriation for its certification program of $110,000 for this Fiscal Year. Position funding and authorization requested would provide for the recruitment of an additional administrative officer, one inspector and one clerk-stenographer. Pesticide program officials are very concerned that EPA grant allocations to the states may be cut or reduced, and as North Carolina will be heavily involved in enforcement of FIFRA after the certification requirements become effective October 21, 1977, a lack of federal funds for the certification program could possibly terminate the state's effort in training and certifying private applicators. The Pesticide staff also needs to develop a better emergency reaction team capability for handling pesticide accidents. Such a program is currently operable, but funding may be reduced.

Pesticide staff officials maintain that they require at least $250,000 per year for their certification program and for a storage and disposal of pesticides capability. If disposal funds were obtained, the Pesticide staff would likely contract with private firms so that degrading, detoxification and/or decontamination of pesticides to be disposed of could be performed. Additional funds would be used for the issuance of identification cards and other items. An additional six positions, including two analytical chemists, two inspectors and two administrative officers, would be needed over the next five years for this effort. The additional personnel would probably be assigned to such tasks as further developing regulations and programs needed for storage and disposal, as well as for emergency response capabilities. Again, state budget restrictions may preclude the development of such programs.

Structural Pest Control staff officials expect that over the next five years the numbers of certified structural pesticide applicators will increase; as such, maintenance personnel who apply pesticides in government buildings will require certification.

The following table represents best professional estimates of the numbers of certified/licensed commercial pesticide applicators (ground and aerial), dealers, consultants, public operators and private applicators to 1982.

TABLE V

North Carolina Pesticides Workforce: Projected Numbers to be Licensed or Certified to 1982

Category	1976	1977	1978	1979	1980	1981
Commercial Applicators	1,355	1,400	1,500	1,700	1,900	2,000
Pesticide Dealers	1,641	1,625	1,600	1,575	1,550	1,500
Pest Control Consultants	36	36	36	36	36	36
Public Operators	811	850	900	925	150	1,000
Private Applicators	4,000	40,000	50,000	60,000	70,000	80,000
TOTAL	7,843	43,911	54,036	64,286	74,436	84,536

Pesticide program officials expect a significant growth in the number of certified commercial applicators over the next five years and a growth of fifty percent over the next ten years in the number of public operators required to be certified. More landscape supervisors of the Transportation Department, for example, will need to be certified as that Department is currently planning a reorganization. The number of pest control consultants is expected to remain at the present level over the next five years. A drop in the number of pesticide dealers is expected, but the actual decrease will depend on how many restricted-use pesticides will be designated by EPA.

D. Training and Certification

Two pesticide staff specialists are currently attending courses related to the field of pesticides in plant pathology and horticulture at North Carolina State University. Both persons are currently working toward obtaining master's degrees in pesticides management. Time off from the job is provided so that they can attend daytime courses. Personnel of the Pesticide staff receive training in the following areas:

1) Sampling for the proper storage and disposal of pesticides;
2) Registration of pesticides;
3) Plant pests;
4) Identification of pesticides;
5) Information-sharing with other Divisions of the Department of Agriculture;
6) Supervision of employees;
7) Management of personnel concepts.

Most of the training utilized by Pesticide staff consists of on-the-job training, supplemented by formal training courses that are currently being offered for the staff.

The State of North Carolina has had a certification program for commercial applicators since 1973. Commercial pesticide dealers and applicators are annually certified or recertified. Pesticide dealers, pesticide applicators and pest control consultants are required by the Pesticide Law of 1971 to pass a written examination in order to be licensed or certified. The North Carolina General Assembly during their 1976 session concurred that the Pesticide Law of 1971 as written granted legal authority for certification or private applicators. The Department of Health Services is also currently working on developing procedures for the safe disposal of pesticides and pesticide containers.

North Carolina has 99,939 farms of which 77,526 are small farms with gross sales of less than $20,000 annually, according to a 1974 census of agriculture preliminary reports. Pesticide staff officials stated that North Carolina has over 120,000 individual-unit farmers (third in the nation) who mostly farm small tobacco allotments. The Pesticide staff and Extension Service personnel from North Carolina State University are currently conducting certification sessions which will train approximately 40,000 private pesticide applicators by the time FIFRA becomes effective. The training is being conducted by one Extension Service training person for each of North Carolina's one hundred counties; sessions last up to four hours. Private applicator training is being accomplished according to the following schedule:

Date	Numbers Trained (Cumulative)
October, 1976	2,000
December, 1976	6,000
February, 1977	10,000
March 31, 1977	30,000
October 21, 1977	40,000

An additional 20,000 to 40,000 private applicators will require training and certification after the summer growing season, later in 1977, to bring the total number of private applicators requiring certification in 1977 to 60,000 or 80,000.

E. Career Potential

It is anticipated by Pesticide staff officials that the North Carolina program will recruit on a limited basis new career positions in the next five years. They would like to recruit toxicologists, but cannot due to lack of funds. Additional analytical chemists, inspectors and administrative officers are to be recruited by the Pesticide staff, according to current projections made by program officials.

The majority of the pesticide workforce jobs are likely to be in private sector during the next five years. The North Carolina pesticide program has a critical need for disposal facilities for the proper management of disposal of pesticides and pesticide containers. Private firms could be contracted by the state to provide such disposal services. A significant growth in the numbers of commercial applicators may develop over the next five years, as many private applicators may choose to contract with commercial applicators for the application of pesticides rather than becoming certified themselves. However, the increase in the number of commercial applicators in the next five years is not expected to be as great as in other states where training and certification requirements for the licensing of private applicators are much more complicated and difficult.

F. Conclusion

As in many other states in Region IV, the North Carolina pesticide program is experiencing tight fiscal constraints which preclude the hiring of significant numbers of additional program personnel. Future growth is contingent on the directions and funding available from federal agencies, as the North Carolina General Assembly is unlikely to support major program staffing increases. Training of private applicators is expected to continue beyond the October 21, 1977 deadline when FIFRA's certification requirements become effective, as fewer than the expected number of private applicators are attending current training and certification sessions. Between 60,000 and 80,000 private applicators are estimated to require training and certification to comply with the mandates of FIFRA. The number of commercial applicators in the state is expected to continually increase during the next five years.

Pesticide staff officials state that they expect the principal effect of the Toxic Substances Control Act in North Carolina to be on the manufacturers of chemical intermediates used in the creation of pesticides. The federal legislation requires these manufacturers to provide data to the regulators before the products are placed on the market. Impact of the new Act on the state agencies will be to administer and implement the mandates provided for in the Act, according to state officials.

IV. POTABLE WATER

A. Introduction

Water supply program responsibilities in North Carolina are entrusted to the Department of Human Resources under Chapter 130, Article 13 of the General Statutes of North Carolina. This article states in part that for the ". . .purpose of promoting a safe and healthful environment, and developing such corrective measures as may be required to minimize environmental health hazards, the Department of Human Resources shall maintain appropriate units of sanitary engineering and sanitation." The Federal Safe Drinking Water Act is anticipated to impact the growth potential of North Carolina's water supply program greatly in the next few years. Growth is tied to the EPA definition of what is required under the Federal Safe Drinking Water Act. It is expected by program officials that by 1981, there will be 18,000 public water systems according to the EPA definition. The State of North Carolina has applied for primary enforcement responsibilities of the Act. The North Carolina Legislature is currently meeting in its biennial session (January, 1977) and has before it an expansion request from the Department for Fiscal Years 1977 and 1978. The expansion budget request is undergoing a legislative review process. The Legislature will also have to make necessary revisions of the North Carolina General Statutes in order to comply with the mandates of the Safe Drinking Water Act. Even if the state does not obtain primary enforcement responsibilities for the Act, program officials state that additional personnel are needed to maintain existing programs.

At the present time, North Carolina has an estimated 15,000 water supplies. Three thousand community water supplies and twelve thousand water supplies are included in the estimate. A list of non-community water supplies has not yet been formulated. There are approximately 2,000 groundwater systems, and a total of 3,000 water systems, excluding municipal and industrial water supplies, but including subdivisions and trailer parks. Most of these 3,000 public water supplies are not run by certified operators.

The expansion budget request and projections based upon it are dependent upon several variables. If the Legislature passes the budget request, but does not change the laws so as to be in compliance with the Safe Drinking Water Act, primary enforcement responsibilities will not be obtained by the state.

The Washington State Department of Social and Health Services' Water Supply and Waste Section recently completed a study entitled State Programs for Financing Rural Water Systems, by Robert L. Wubbena and Eric W. Slagle. The State of North Carolina was included as one of two states with a major funding program that attempts to deal with water supply problems in a thorough and comprehensive manner. The authors of the study completed a preliminary review of existing state and federal funding programs and chose the North Carolina and Washington State programs as a base of reference. Mr. Joseph F. Riley reviewed the North Carolina program and published his findings in the August, 1976, issue of the Journal of the American Water Works Association. The following conclusions were reached for the North Carolina program by Mr. Riley:

1) A 1973 needs survey indicated a five-year construction need of $500 million for water supply systems;

2) The program needs have not changed appreciably from 1973 to 1976 except inflation costs;

3) The grant program has had tremendous positive impact on the improvement programs of all public water systems;

4) Counties are proposing changes to improve coverage of public water and sewer systems;

5) New public systems are being built or expanded;

6) New systems now have capacity for serving more rural areas;

7) Federal, state and local governments are working closer together on common objectives, specifically safe water;

8) State money is not dependent on federal funds, consequently state and local needs are realized;

9) Proliferation of privately-owned public systems is continuing (due to cost of construction differential between rural and urban design standards).

The North Carolina Legislature passed a "Regional Planning and Sewage Disposal Planning Act of 1971" to give financial stimulus to regional planning so as to reduce the number of systems serving fewer than 1,000 customers. The grant program was established to encourage aid to regional projects, and gave such projects a higher priority.

North Carolina has about 150 surface water treatment plants and between 50 and 60 groundwater systems which are treated according to chemical content. Sixty water treatment plants are treated in a formal manner. North Carolina has 513 municipal water supplies which are owned by municipalities and water associations. Surface water treatment plants are treated by rapid gravity sand filtration, sedimentation, chlorination, coagulation and filtration. North Carolina has approximately 300 mobile home parks and subdivisions which have water supply systems. A recent trend developing in North Carolina is for one company that owns several water supply systems to connect to a regional or larger system located in the vicinity.

B. Workforce Profile

The Water Supply Branch is one of four branches in the Division of Health Services' Sanitary Engineering Section. The Engineering Planning Branch also has water supply program responsibilities, but none of a surveillance nature. Sub-branches included in the Engineering Planning Branch include Water Supply Grants, Water and Sewage Plan Review, Regional Water Supply Planning, and Food and Lodging Plan Review. The Engineering Planning Branch has a total staff of 14 positions, of which ten are environmental engineers, two are clerk-stenos, one is an administrative officer, and one is a secretary.

The Water Supply Branch, which has surveillance responsibilities, has a total staff of twenty-two persons at the headquarters office in Raleigh and in the four regional offices. The Branch head and an assistant Branch head provide technical authority and supervision to four regional offices. Two environmental engineers, a secretary and a stenographer assist them in the performance of their duties. Sixteen other technical and engineering personnel are located in the Western Regional Office, the North Central Regional Office, the South Central Regional Office and the Eastern Regional Office. The following table depicts the total number of persons in the Water Supply Branch currently engaged in water supply program activities. The table does not include the Engineering Planning Branch or the personnel providing laboratory support in the Environmental Sciences Laboratory, which is also a part of the Division of Health Services. The workforce profile of the Environmental Sciences Laboratory is covered in a separate table.

TABLE VI

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES

Division of Health Services
Sanitary Engineering Section
Water Supply Branch

Current (1976) Staffing Level

Position	1976
Engineer	10
Scientist	2
Technician	8
Other*	2
TOTAL	22

*Includes one secretary and one stenographer

Most of the ten engineering positions depicted in Table VI are of the environmental engineering position classification. At the entry level, an environmental engineer requires graduation from a four-year college or university with a major in civil, environmental, public health, sanitary or other engineering curriculum relevant to the area of work and one year of experience in environmental engineering.

The "scientist" positions described in Table VI are classified as water treatment plant consultants. Water treatment plant consultants are specialists who provide assistance to water treatment plants. The technician positions depicted in Table VI represent environmental engineering technicians who review and evaluate engineering data for the purpose of analyzing or storing information on the environmental quality of state public water systems. The position requires, at the minimum, graduation from high school and successful completion of courses in algebra and geometry.

The Division of Health Services' Environmental Sciences Laboratory performs analytical laboratory work for the Water Supply Branch, analyzing samples from both public and private water supplies. Both the Water Supply Branch and the Environmental Sciences Laboratory recruit through normal Merit System procedures. Promotion is usually carried out from within, and personnel are hired at the entry level as much as possible. The director of the Laboratory is assisted by a staff of 19 persons, which is depicted in the following table.

TABLE VII

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES

Division of Health Services
Environmental Sciences Laboratory

Current (1976) Staffing Level

Position	1976
Chemist	9
Microbiologist	2
Technician	8
TOTAL	19

Four of the chemists depicted in Table VII are assigned water supply analytical duties. One chemist in the Laboratory's Occupational Health component performs petroleum and pesticide analyses. Four chemical analysts are employed by the Laboratory that also have radiation-related duties. According to the State Merit System position description for a chemical analyst, at the entry level, graduation from a four-year college or university, including or supplemented by twelve semester hours of chemistry, would qualify a candidate for this position. The job involves regulatory and service work in performing the more complex standardized laboratory tests and analyses requiring an application of practical analytical chemistry.

The head of the Water Supply Branch estimated that at the present time (1976) there are approximately 1,700 certified water treatment plant operators in the A, B and C classes. The Branch was unable to provide a current total listing of the breakdown of certified operators, but the total number was considered to be in the same proportion as listed in Volume XLIX, Number 1, Journal of the North Carolina Section of the American Water Works Association and the North Carolina Water Pollution Control Association. The article was taken from proceedings which were held in Wilmington, North Carolina in 1973 at the Association's 53rd Annual Meeting. The article is entitled, "Roster of Certified Water Treatment Facility Operators Who Have Been Issued Certificates Under Article 2, Chapter 90A of the General Statutes of North Carolina as of March 1, 1974". At that time there were:

193	"A" Certificates
202	"B" Certificates
408	"C" Certificates
65	"C - Well" Certificates
868	Total

The 1976 level has been extrapolated from the 1974 list in the same proportion to fit the total current number of 1,700 certified water treatment plant operators. Article 2, Chapter 90A of the General Statutes of North Carolina requires that each of the State's approximately 1,700 public water supplies have at least one certified operator in charge and responsible for proper operations of the facility. The State of North Carolina has approximately 250 treatment facilities with 1,700 operators certified in 1976. The following table depicts the current number of certified water treatment plant operators by category.

TABLE VIII
Current (1976) North Carolina Certified
Water Treatment Plant Operators (est.)

Classification	1976
A	386
B	402
C	816
C-Well	130
TOTAL	1,734

North Carolina has approximately 2,200 public water systems (January 1977) and about 2,000 of the systems do not have certified operators in charge. Program officials estimate that in many cases, one certified operator operates four to five water supply systems.

C. Workforce Projections

Workforce projections for the Water Supply Branch's surveillance and enforcement responsibilities were based on the best professional judgments of Water Supply Branch professionals and under the EPA guideline projections, and only the need for engineers has been projected. These projections are based on formulas developed for the State Implementation Plan regulations in Appendix B of the Federal Register, and based on the cost per year per system and the number of community and non-community supplies. The projections given by Water Supply Branch officials are close to those obtainable using NSF formulas. Under the EPA Implementation Plan Regulations, the projections are based on:

1 engineer for every 56 water systems
1 administrator for every 10 technical people, and 1 secretary
3 engineers for every community water supply and 1 secretary
4 engineers for every non-community supply

The staffing projections are considered by program officials to be valid for the next two years if the North Carolina Legislature approves the expansion budget request, modifies North Carolina's water law, and the State achieves primacy over enforcement of the Federal Safe Drinking Water Act. If EPA accepts North Carolina's application for primary enforcement responsibilities under the Safe Drinking Water Act, the Water Supply Branch's total staffing level will dramatically increase over the next five years. An estimated additional 260 positions will thus be added by 1981.

The following projections are for the first two years, Fiscal Years 1977 and 1978 under the expansion budget request. In making the projections, the head of the Water Supply Branch used the EPA/NSF formula which counts the number of public water systems currently under surveillance and the additional systems that will be picked up using the EPA definition. The Water Supply Branch plans to recruit for FY 1977-1978 three water plant consultants, one chemist, and one biologist. The projections are based on the availability of an EPA grant that was used to complement staffing capabilities, to be able to acquire primary enforcement responsibilities. To cover the period July 1, 1977 to June 30, 1978, program officials called for an increase of between 42 to 44 engineers. The Branch also plans to hire a new assistant director, and two environmental engineers to increase program technicial capabilities. Two attorneys and one hearing officer may be hired by the Water Supply Branch. A secretarial staff will be provided for all three, as will a court stenographer. The following table represents what the Water Supply Branch estimates to be the state's program needs over the next five years (1977-1982) if enforcement of all 18,000 supplies under EPA definition is phased in (in person years).

STAFF NEEDS

Divisions	1977	1978	1979	1980	1981	1982
Surveillance						
Community	52	53	90	108	109	110
Non-Community	.2	1	1	26	26	48
Program Assistance						
Community	17	17	29	35	36	36
Non-Community	.02	.1	.2	.3	3	6
Administrative	9	9	14	17	19	22
Clerical						
Community	23	23	40	48	48	49
Non-Community	.005	.28	.3	1	7	14
Administrative	3	3	4	5	6	7
TOTALS						
Community	92	93	159	191	193	195
Non-Community	.28	1.38	1.5	3	36	68
Administrative	12	12	18	22	25	29
Technical (engineering)	69	71	120	145	174	200
Clerical	26	26	44	54	61	70
Administrative (engineering)	9	9	14	17	19	22

The expansion budget request submitted to the North Carolina Legislature seeks authorization for the recruitment of 140 additional positions for Fiscal Years 1977-1978.

Water Supply Branch officials expect their staff to increase in size from approximately forty persons during Fiscal Year 1976 to three hundred persons by 1982. Laboratory personnel are not included in these estimates and the total number of 300 persons needed includes estimates for the Engineering Planning Branch. The projections are based on the assumption that the state will achieve primacy and revisions will be made in the state's laws. The following projections depicted in Table IX are based on calculations using the EPA/NSF formulas and are dependent on whether or not North Carolina approves the expansion budget request.

TABLE IX

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES

Potable Water Program Operations
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Administrative	6	9	9	14	17	19	n/a	28%
Engineer	14	69	71	120	145	174	1%	101%
Clerical/ Other	20	26	26	44	54	61	5%	27%
	40	104	106	178	216	254	4%	54%

The preceding table includes both the Water Supply Branch and the Engineering Planning Branch. Technician level positions are not included because they have proven unsatisfactory and are expected to be phased out over the next several years. A tabulation for 1982 is not included in the above table, but projections include 200 technical/engineering, 22 engineering/administrative positions and 70 clerical/other positions. The administrative positions listed in Table IX are to be filled by engineers.

The director of the Department's Environmental Sciences Laboratory is asking for an additional 25 positions from the North Carolina General Assembly to provide support for the Safe Drinking Water Act. The 25 positions are expected to satisfy the Laboratory's growth requirements for the next three years until implementation of the Safe Drinking Water Act is fully mobilized. The intent is to increase the staff, initially, rather than in subsequent years. The Environmental Sciences Laboratory experiences more turnover than normal, approximately 20% annually primarily because it is located in an unstable academic community. The twenty-five persons to be recruited in the next three years include the following positions listed in Table X.

TABLE X

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES

Division of Health Services
Environmental Sciences Laboratory
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Chemist	9	11	13	15	15	15		11%
Microbiologist	2	2	3	3	3	3		10%
Technician	8	12	16	19	19	19		15%
Other	n/a	2	4	7	7	7		35%
	19	27	36	44	44	44	20%	13%

Program officials estimate that the 1976 total of 1,734 certified water treatment plant operators is expected to increase by 150 to 175 operators each year through 1981. The "C" classification is approximately one-half of the total number of certified operators, and this category is expected to increase by 88 operators annually. The "B" category is second highest, and is expected to increase by 44 operators each year. The "A" category is expected to increase by 40 operators annually. The number of "C-well" operators is expected to increase by 20 operators each year. State sources estimate that 300 operators need upgrade training each year. The Federal Safe Drinking Water Act regulations become effective in June 1977, and there is not expected to be a dramatic increase in the total numbers of certified operators other than "C-well" operators in the state. Under the new regulations, as persons become more qualified to run well systems there will be an increase in the total number of these operators. The following table depicts the projected growth for certified operators in the next five years for water treatment plant operations, subject to information currently available and based upon estimates of program officials.

TABLE XI

NORTH CAROLINA WATER TREATMENT PLANT OPERATORS
Workforce Projections to 1982 (est.)

Classification	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
A	386	426	466	506	546	586	20%	9%
B	402	446	490	534	578	622		9%
C	816	904	991	1,079	1,166	1,254		9%
C-well	130	150	170	190	210	230		12%
TOTAL	1,734	1,926	2,117	2,309	2,500	2,692	20%	9%

D. Training and Certification

The Water Supply Branch has no formal in-house training program for staff at the present time. The Branch intends to initiate an in-house training program for staff if the State General Assembly revises its statutes to enable North Carolina to achieve primacy for the enforcement of the Safe Drinking Water Act. The General Assembly will need to appropriate funds if such a training program is to be initiated. The Water Supply Branch is currently operating on a very tight budget and additional allocations made now for training would overtax their budget.

The water and wastewater school in Neosho, Missouri, is considered by North Carolina program officials to have a highly concentrated sanitary engineering education program for operators. The Water Supply Branch has recruited two retired Navy personnel and one college graduate from the Neosho program.

The Water Branch has recruited personnel from the Fayetteville Technical Institute which has a Sanitary Engineering Associate Degree program for the training of water supply and sewage treatment personnel. Their program is orientated toward both theory and practical operator training.

The Thirty-Seventh Annual Waterworks Operator School (1976) was held on the campus of North Carolina State University. It is conducted by the North Carolina Waterworks Association for the North Carolina Water Treatment Facility Operator Certification Board. The 1976 session was conducted by the Department of Civil Engineering within the University's School of Engineering and the Division of Continuing Education.

The Waterworks Operator's School conducts a training program for Class A, B, and C groups for the purpose of improving the general level of water plant operation. In order to meet the needs of operators at all levels, the School introduces sound techniques and latest treatment plant developments to the participants of their classes. The program is divided to prepare operators for examinations in the classification for which they are applying. A two-day program was offered for "C-well" operators and a one-day program devoted to the Safe Drinking Water Act, was offered during the Advanced Section of the School's program.

Water Supply Branch officials estimated that 420 people attended various training schools for water treatment plant operators during 1975. The total includes the lowest category, "C-well" all the way up to the B, A and Advanced Group level. In the advanced group, program officials stated that all operators at the advanced level come in to the school for new knowledge and technical approaches. The "Program of Instruction" for the 1976 Waterworks Operators' School included the following course offerings, which are adapted from its program listing:

> Program of Instruction for the Courses offered during the 1976 Waterworks Operators' School at North Carolina State University in Raleigh, N.C., July 26-July 30, 1976:
>
> (1) Plant Math
> (2) Bacteriology
> (3) Hydraulics
> (4) Iron and Manganese removal
> (5) Design
> (6) Pumps
> (7) Plant Chemicals
> (8) Chlorination
> (9) Chemistry
> (10) Radiation

(11) Corrosion
(12) Safety and OSHA
(13) Records
(14) Coagulation
(15) Fluoridation
(16) Sedimentation and Filtration
(17) Taste and Odor
(18) Standards
(19) Safety

The Program of Instruction for C-Well Operators (lowest level)

(1) Basic Mathematics
(2) Geology
(3) Ground Water Hydraulics
(4) Construction, Operation and Maintenance of Wells and Pumps
(5) Water System Controls
(6) Water Bacteriology, Sampling and Analysis
(7) Sanitary Protection of Water Supplies
(8) Chemical Quality
(9) Treatment Processes
(10) Chlorination
(11) Distribution Systems
(12) Records

Environmental Sciences Laboratory personnel receive primarily on-the-job training, as there are no funds available for extensive training of Laboratory staff. Several persons have been sent from the Environmental Sciences Laboratory to EPA training courses, but Laboratory officials maintain that the tuitions charged have become prohibitive for this resource to continue to be utilized as some of the EPA laboratory courses cost $45 per day.

E. Career Potential

The Water Supply Branch and the Engineering Planning Branch will primarily hire engineering personnel once the state has obtained primacy for taking over enforcement responsibilities of the Safe Drinking Water Act from the U.S. Environmental Protection Agency. To assist in enforcement, several hearing officers and court stenographers are planned to be hired in Fiscal 1977-1978. The career potential for engineers to find employment with the State of North Carolina's potable water program is very good for the next five-year period, due to the expectation that primacy will be obtained and staffing levels will increase from approximately forty positions to 300 positions by the end of Fiscal Year 1982.

F. Conclusion

The State of North Carolina's potable water program is now in a dramatic growth situation because of the Safe Drinking Water Act. Achievement of primacy for the Act is contingent on whether or not the State Legislature modifies North Carolina's General Statutes (Chapter 130, Article 13) to fit the EPA definitions under the Safe Drinking Water Act. Growth is also contingent on whether or not the State Legislature approves the program's expansion budget request when it meets in Bienniel Session in the first half of 1977 to examine the budget for Fiscal Years 1977 and 1978.

V. RADIATION

A. Introduction

North Carolina's radiation control legislation was enacted in 1959 (Chapter 104-C of the General Statutes) to control sources of ionizing radiation. This legislation provided for the adoption of reasonable rules and regulations for protecting the citizenry from radioactivity and ionizing radiation. It also provided for the registration of users of radioactive materials and for the inspection of facilities. The General Assembly later amended Chapter 104-C in 1963 to designate the North Carolina Board of Health as the agency responsible for providing rules and regulations for the licensing of by-product, source and special nuclear materials. The State General Assembly amended this legislation to attain Agreement State Status with the Nuclear Regulatory Commission. After a period of program development and revising regulations, North Carolina achieved Agreement State Status in 1964. A Committee on Radiation Hazards in 1975 recommended to the General Assembly that Chapter 104-C be completely revised. The result was the North Carolina Radiation Protection Act (GS-104-E) which became effective July 1, 1975.

The North Carolina Radiation Protection Act provided for the creation of a Radiation Protection Commission of 11 members and authorized it to assist the Department of Human Resources in the development of a comprehensive radiation protection program. Until 1973, the North Carolina radiation protection program was the responsibility of the State Board of Health. Under a reorganization, the program was transferred to the new Division of Facility Services under the Department of Human Resources.

B. Workforce Profile

Within the Department of Human Resources, the Radiation Protection Branch is responsible for carrying out the State's radiation protection program. The Branch has four functional units which have the following abbreviated responsibilities:

(1) X-Ray Control Unit: Responsible for the registration and inspection of all X-ray machines and other machines which emit ionizing radiation. Provides a consultative service for such areas as diagnostic X-ray techniques, dark room procedures and various other radiation practices not subject to regulation. Participates in technical meetings of user groups and provides workshops/seminars for users. There were 6,711 X-ray producing machines and 2,494 registered X-ray facilities as of July 1, 1976. Present staffing allows for an average frequency of inspection of these machines and facilities once every 10 to 12 years.

(2) Radioactive Materials Control Unit: Responsible for the inspection and licensing of all radioactive material users in North Carolina. Reviews applications for licenses to user radioactive materials submitted by user facilities. In 1976, there were 384 active radioactive materials licenses issued and 269 facilities which possess and use radioactive materials under general license. The Radioactive Materials Licensing and Inspection Program is conducted under an agreement made between the Governor of North Carolina and the U. S. Nuclear Regulatory Commission (NRC) and is subject to an annual review by NRC to determine continued compatibility.

(3) Environmental Surveillance and Nuclear Facilities Unit: Performs non-regulatory furctions such as monitoring levels of radioactivity throughout the State. Evaluates Nuclear Regulatory Commission technical reports from four nuclear reactor sites.

(4) Administrative Assistance and Emergency Planning Unit: Prepares a "Radiation Emergency Response Contingency Plan" designed to ensure a prompt, effective and coordinated response to protect the public health in the event that accidents involving sources of radiation occur. Program officials estimate that there are approximately eight to ten accidents per year which require

> a coordinated emergency response effort by this unit to ensure that the emergency response program is effective.

Sanitarians and public health officials of municipal health departments assist the Radiation Protection Branch in monitoring various areas of North Carolina by collecting samples for laboratory analysis. The Division of Health Services Laboratory conducts all sample analyses for the Radiation Protection Branch. The numbers of samples actually collected for analysis are not adequate to fulfill the goals of the Radiation Protection Branch.

TABLE XII

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES
Division of Facility Services
Radiation Protection Branch
Current (1976) Staffing Level

Position	1976
Health Physicist	4
Engineer	2
X-Ray Inspector	5
Other	4
TOTAL	15

The supervisor of the Environmental Surveillance and Nuclear Facilities Unit is an environmental engineer. This person is assisted by an additional environmental engineer. The X-ray Control Unit has four technician level inspectors who are classified as Radiation Equipment Specialists. These positions are degreed positions which also requires experience as a prerequisite to being hired. One planner and three secretaries are included in the "other" category.

Radiation Protection Branch officials estimate that there are 3,500 persons who have been designated to serve as radiation safety officers for user facilities in North Carolina. Within the State are 2,949 registered X-ray facilities, 384 active users with specific radioactive materials user licenses and 269 facilities which use radioactive materials under general license. Each user facility is required by state law to have at least one person designated to fulfill radiation safety officer functions even if the person fulfilling a part-time role is a medical doctor or a dentist.

Carolina Power and Light Company has twenty to thirty radiation safety officers at its Brunswick nuclear plant and in the corporate office. The General Electric Fuel Fabrication Plant has about fifteen persons conducting radiation monitoring testings. In sum, it has been estimated that including both the public and private sectors, there are approximately 3,550 persons in North Carolina who have radiation usage and control responsibility on either a full- or part-time basis.

C. Workforce Projections

Workforce projections for the Radiation Protection Branch are based on the professional judgements of the Branch's administrators. In its biennium budget request submitted to the North Carolina General Assembly for Fiscal Years 1977 and 1978, the Branch has requested seven additional personnel. The requested positions include two radiation equipment specialists, one health physicist, one radiochemist, one environmental radiation technician and two clerical personnel. The two requested radiation equipment specialists are needed for survey and inspection activities of the X-ray Control Unit. Survey duties would also be conducted by the health physicist planned for the Radioactive Materials Control Unit. The environmental radiation technician would collect samples for the Environmental Radiation Surveillance Unit. Included in the projection, but not under the jurisdiction of the Radiation Protection Branch, is the radiochemist position which would be assigned to the Division's Laboratory to assist its three-member environmental radiation surveillance staff. The above projections are considered the minimum necessary for 1977, 1978, and 1979 operations. Three radiation equipment specialists, one health physicist, two environmental radiation technicians, one laboratory technician and a secretary are projected for 1979-1981.

If additional funding or authorization is not obtained for the requested positions considered necessary for Branch operations for the next two years, (Fiscal Years 1977-1978), the Branch may have to discontinue its environmental surveillance program. Additional monitoring equipment is necessary for the continuance of the activities of the Environmental Surveillance and Nuclear Facilities Unit. The following table depicts estimated workforce projections for radiation control activities of the Radiation Protection branch and the Division of Health Services Laboratory.

TABLE XIII

NORTH CAROLINA DIVISION OF HEALTH SERVICES LABORATORY

Radiation Protection Branch
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Health Physicist	4	5	5	6	6	6	n/a	9%
Engineer	2	2	2	2	2	2	n/a	0%
Inspectors	5	8	8	13	13	13	n/a	13%
Other	4	6	6	7	7	7	n/a	13%
TOTAL	15	21	21	28	28	28	17%	12%

Together, the Radiation Protection Branch and the Division of Health Services' Laboratory have an average annual turnover of two to three positions. This is about a 17% average annual turnover rate. Radiation control officials are not optimistic that the North Carolina General Assembly will approve the total requested list of positions for Fiscal Years 1977-1978, but no staff decline is anticipated in any case.

It is projected by state program officials that Duke Power Company will increase its staff of radiation safety officers, some of whom will be health physicists, by ten to thirty positions over the next five years. Other than this, Branch officials do not anticipate any further increase in the number of health physicists employed in the private sector over the next five-year period.

D. Training and Certification

Most training provided by the Radiation Protection Branch's staff is on-the-job as no state-sponsored training courses are offered for radiation control personnel by the municipalities or the private sector. The State of North Carolina offers a program by which the state pays tuition fees for state employees who attend job-related courses offered by educational institutions. However, according to Branch officials, there are no suitable training courses available to its personnel in the area. The Branch cannot support staff participation adequately in training activities which require tuition fees because of budget constraints.

Because of the specialized nature of the NRC courses, only the staff of the Radiation Protection branch may attend tuition-free training courses sponsored by the Nuclear Regulatory Commission at Oak Ridge.

Staff of the Branch's Radioactive Materials Unit is adequately trained. Branch personnel also occasionally attend staff conferences and informal seminars.

With the above exception, staff training is considered by Branch officials to be a critical need. Radiation Control Branch professionals would like to attend free training courses offered by the Bureau of Radiological Health or the National Center of Radiological Health, but it is difficult for Branch personnel to even utilize free training courses provided by federal agencies due to the state travel and subsistence funding restrictions.

E. Career Potential

Officials of the Radiation Protection Branch foresee no new or unique careers developing in the radiation control field in either the public or private sector. If the Radiation Protection Commission established new regulations for the control of sources of non-ionizing radiation such as microwave ovens and laser devices, new positions would be needed to supplement the present Branch staff.

It is likely that a limited number of positions in surveillance and monitoring activities will become available as projected construction of nuclear generating facilities is completed. These positions will require both degreed and technically trained personnel. The extent to which these positions will develop will be a corollary of future energy demands, hence specific projections would be only speculation.

F. Conclusion

The State of North Carolina's radiological health program is expected to almost double in staffing level by 1982. North Carolina is an Agreement State with the Nuclear Regulatory Commission and as such monitors nuclear installations in the state. The monitoring tasks required by the staff will increase dramatically as several more nuclear power plants are expected to be operational within the next few years. However, the bulk of the nuclear power plants in the state are not expected to become operational until after 1982. Thus, it is not anticipated that dramatic growth in the private sector will occur for radiation control positions until after 1982.

VI. SOLID WASTE

A. Introduction

The North Carolina Solid Waste Disposal Act of 1972 was enacted by the State's General Assembly to serve as North Carolina's solid waste management legislation. The Act designated the State Board of Health to serve as the single state agency to carry out the mandates of the federal Solid Waste Disposal Act (P.L. 89-272) and any other state or federal legislation that may be later enacted to assist the state in the proper disposal of solid waste. The State Board of Health was specifically authorized to:

(1) Engage in research, conduct investigations and surveys, make inspections, and to establish a statewide solid waste disposal program;

(2) Provide standards for the establishment, location, and operation, maintenance, use and discontinuance of solid waste disposal sites and facilities;

(3) Develop a comprehensive program for implementation of safe and sanitary practices for disposal of solid waste throughout the state.

The State Board of Health created the Solid Waste and Vector Control Branch within the Department of Human Resources and charged it with the principal responsibilities of implementing the mandates provided for by the Solid Waste Disposal Act. The Branch is a part of the Sanitary Engineering Section, which is located under the Department's Division of Health Services. About 85% of the landfills in the state are privately owned. The Solid Waste and Vector Control Branch administers the state's solid waste management program through a cooperative arrangement with county landfill operators; the Branch has delegated a large portion of its responsibilities to local county health departments in the state. Branch officials encourage local county commissioners to take over the operations of landfill sites and to set up landfills on a regional basis. The number of sanitary landfills in North Carolina is being substantially reduced as a result of this effort. In 1970, only one or two counties in North Carolina participated in this consolidation/regionalization program, but according to officials of the Solid Waste and Vector Control Branch, all of the state's counties now participate. The principal benefit of such a concept has been that many municipalities surrounding regional county-operated sanitary landfills have been persuaded to dispose of their solid wastes in the county site.

Program officials anticipate the new Federal Resource Conservation and Recovery Act to greatly impact the Branch's staffing level and program importance over the next five-year period. Branch officials are waiting for the U.S. Environmental Protection Agency to develop a list of hazardous materials and in what concentrations such materials are considered hazardous, and for guidelines for the development of disposal facilities to properly dispose of such wastes. The staffing increases that are likely to be made by the Branch are dependent on how quickly EPA implements its portion of the duties required by the new federal legislation. It is anticipated by Branch officials that the new federal Public Law regarding hazardous wastes management could provide impetus to double or triple the size of the Branch's staff within the next three to four years. The new federal law calls for a manifest system to be developed for the collection of hazardous wastes and the system will be necessary to ensure that such wastes are properly disposed of. North Carolina has three to four secure landfills which could safely be used for hazardous waste disposal purposes.

For resource recovery operations, the state has directed its efforts at encouraging private industries to invest in resource recovery facilities that could recover both commercial and industrial wastes. The State General Assembly enacted legislation in January 1976, which authorized the Department of Human Resources to certify facilities which are designed to recover resources. The certification process took effect June 2, 1976, and was retroactive to January, 1976. For the resource recovery facilities which qualify, the state grants a tax exempt status from county property taxes and a 60 month write-off for state tax purposes.

B. Workforce Profile

The Solid Waste and Vector Control Branch has only really grown in stature since 1969-1970. In 1967, the Branch consisted of four persons and in 1976, the Branch has a total staff of 14 persons, including district offices and the vector control program. The majority of the professional staff employed by the Branch are either environmental engineers or sanitarians by profession. The following table illustrates the distribution of Branch personnel by occupation types.

TABLE XIV

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES

Division of Health Services
Sanitary Engineering Section
Solid Waste and Vector Control Branch
Current (1976) Staffing Level

Position	1976
Engineer	3
Sanitarian	9
Other	2
TOTAL	14

The Branch head and his assistant are classified as environmental engineers. They receive administrative support from a clerk-typist and a secretary. These two engineers oversee three programs:

(1) Vector Control,

(2) Solid Waste Management,

(3) Salt Marsh Mosquito.

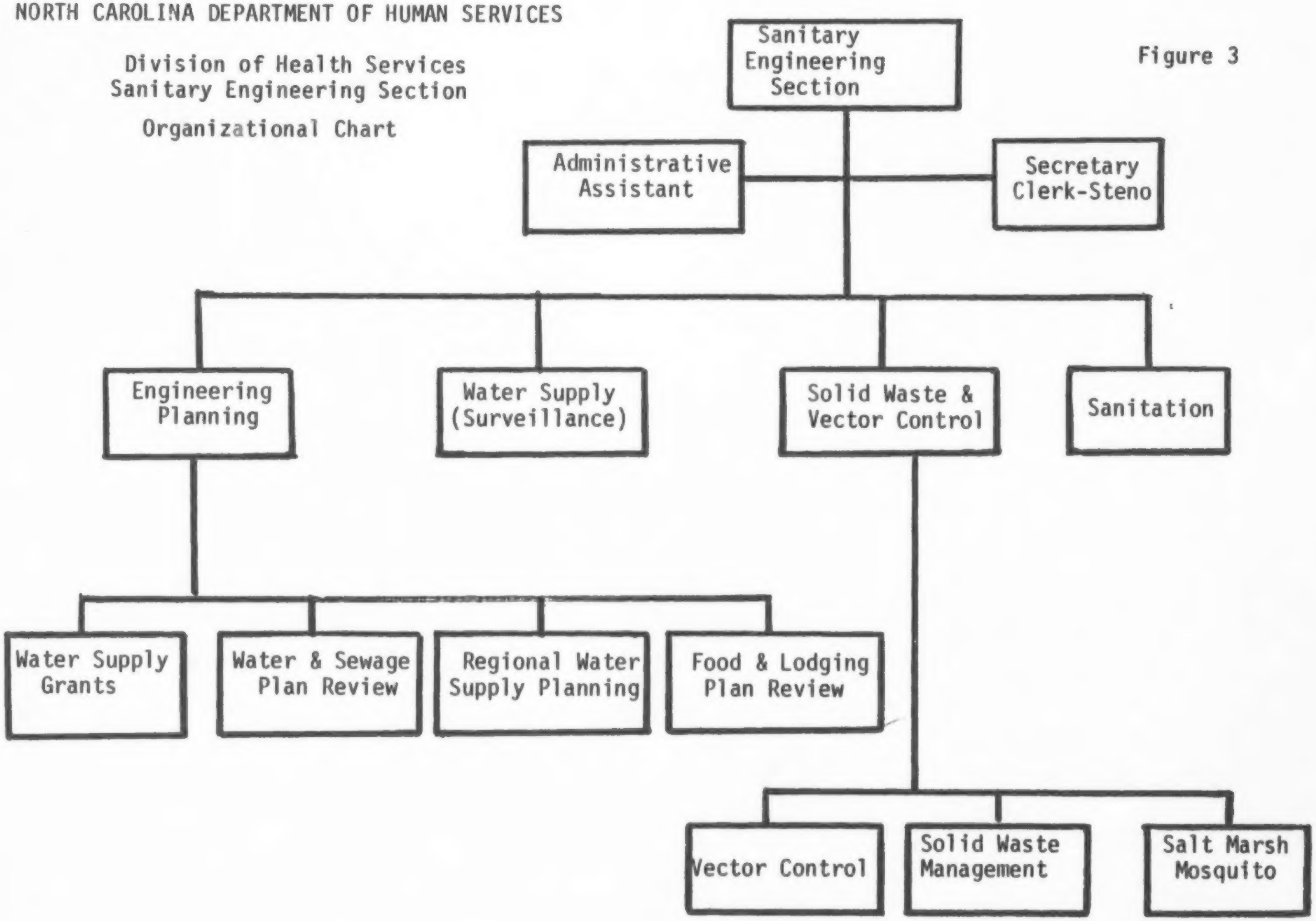
The Vector Control Program is headed by a district sanitarian and the Salt Marsh Mosquito Control Program is headed by an environmental engineer. This environmental engineer is an entomologist by training and serves in a consultant capacity in assisting the Branch's personnel located in regional offices. The Solid Waste Management Program is administered by a sanitarian program supervisor who oversees seven district sanitarians located in regional offices in Black Mountain, Winston-Salem, Fedville and Greenville. Three district sanitarians are stationed in Black Mountain, one in Fedville, two in Greenville and three are located in Winston-Salem. An organizational chart of the Department of Human Resources is depicted on the following page.

NORTH CAROLINA DEPARTMENT OF HUMAN SERVICES

Division of Health Services
Sanitary Engineering Section

Organizational Chart

Figure 3


Sanitary Engineering Section
Administrative Assistant
Secretary Clerk-Steno
Engineering Planning
Water Supply (Surveillance)
Solid Waste & Vector Control
Sanitation
Water Supply Grants
Water & Sewage Plan Review
Regional Water Supply Planning
Food & Lodging Plan Review
Vector Control
Solid Waste Management
Salt Marsh Mosquito

The state has 410 municipalities with one to four hundred persons on their solid waste collection force. Every county has private collectors working on a contractural basis in rural areas.

Approximately four heavy equipment operators are employed at each of 160 landfill sites in the state for a total of about 600 operators. Weighmasters are employed at twelve landfill sites in the state. There are eight or nine pieces of heavy equipment at each of these 160 landfill sites. However, only a few mechanics are employed on a full-time basis to maintain the equipment. Approximately twenty sanitary landfills in North Carolina employ a full-time foreman-operator to supervise disposal operations. Most landfill sites in North Carolina are small. About 25% (forty sites) have either a foreman or a spotter employed on a full-time basis; about one-half (eighty landfill sites) employ gatemen.

The state program recruits personnel primarily from local health departments in North Carolina as the Branch prefers personnel with broad public health experience. One new employee has been recruited from the South Carolina Water Pollution Control Commission and another came from the North Carolina State University Extension Service.

C. Workforce Projections

Administrators of the Solid Waste and Vector Control Branch project significant increases in the solid waste management program in the next five years as a result of the new Federal Resource Conservation and Recovery Act. Turnover within the Branch is estimated at less than five percent annually and most of the Branch's fourteen employees have been with the Branch for at least four years. In the last several years, only one person left employment with the Branch and it was because of medical retirement.

In order to prepare for implementation of the new Federal Act, the Branch plans to recruit one chemist by February 1, 1977. By 1980 or 1981, the Branch hopes to recruit two additional chemical engineers, sixteen to twenty sanitarians and two or three secretaries. The personnel can only be recruited if the State General Assembly grants approval for these positions. When they are recruited is dependent on how quickly EPA carries out the mandates entrusted to it by the new Federal Act. Workforce projections for the Branch, by position, are depicted in the following table.

TABLE XV

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES

Division of Health Services
Sanitary Engineering Section
Solid Waste and Vector Control Branch
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	3	4	5	5	5	5	n/a	11%
Sanitarian	9	14	19	24	26	29	n/a	27%
Chemist	0	1	1	1	1	1	n/a	20%
Other	2	3	5	6	6	6	n/a	27%
TOTAL	14	22	30	36	38	41	4%	25%

D. Training and Certification

The Branch conducts a one-week in-house training course each year in cooperation with EPA. The instructors usually come to Raleigh from the EPA National Training Center at Cincinnati. The Branch's district sanitarians are brought to Raleigh from the regional offices for this training session which usually concerns how to implement the required EPA regulations. A three-day seminar was held at the beginning of 1977 which concerned developing a hazardous wastes survey in North Carolina.

The EPA Regional Office in Atlanta conducted a training course November 8-10, 1976, for new personnel working in the field of solid waste management. One person from the Branch attended this course.

East Carolina State University, according to Branch officials, offers the only environmental health program in the state. Its program is similar to the one conducted by the University of Tennessee at Knoxville. The University of North Carolina at Chapel Hill offers a public health program leading to a Master's or a Ph.D. degree. North Carolina State University and Duke University have conducted workshops in the public health field but offer no formal course work in the environmental public health field.

The Wilson County Technical Institute at Wilson, North Carolina, is beginning a training program to instruct heavy equipment operators in the proper management of sanitary landfills. The program is designed to be completed in two years and is oriented toward the presentation of solid waste management techniques. Graduates from the Institute who have Associate Degrees in Sanitary Landfill Technology can have their credits transferred to a university's engineering school. The program is the first such program to be offered in the nation; EPA and other state agencies have expressed interest in it. Students participating in the program gain practical experience by actually constructing and operating a sanitary landfill site.

The Branch's sanitarian program supervisor serves on a committee which assisted in the development of the Institute's program format. The course is designed so that the student can obtain certification at the end of the twelfth month. If the student elects to participate in the Sanitary Landfill Operator-Manager Option Program, students receive instruction from textbooks and experience with heavy equipment. The program is designed to fill the training gap between those professionals who are highly technically trained in the planning and design of a solid waste management program and those who actually run the sanitary landfills. Once the program is fully implemented at the Institute, the Branch intends to begin a certification program for landfill operators in the state. (See APPENDIX for courses offered at Wilson County Technical Institute.)

E. Career Potential

As a result of the new Federal Resource Conservation and Recovery Act, the career potential in the field of solid waste management in North Carolina is expected by state program officials to improve dramatically. The state plans to employ additional chemical engineers, a chemist, sanitarians, secretaries, and a data processor in the next five years once a state implementation plan is developed and approved by both the State General Assembly and EPA. Just how many additional personnel will be required by the state program is uncertain until the Branch has completed its survey of what hazardous materials are generated in North Carolina and the General Assembly decides just how deeply it wants to become involved in promoting resource recovery operations.

F. Conclusion

The North Carolina solid waste management program is currently devising plans for handling hazardous waste materials in a manner acceptable under EPA guidelines and the new federal legislation. The size of the state program is expected by Branch officials to double or triple over the next five years. The actual timetable governing such dramatic growth is dependent on how quickly EPA implements its portion of the activities mandated by the Resource Conservation and Recovery Act.

North Carolina has not developed concrete plans regarding resource recovery operations. The General Assembly has, however, recently enacted legislation requiring the certification of equipment and facilities used in resource recovery operations. In 1976, according to program officials, more than one hundred resource recovery site owners have applied for such a certificate.

North Carolina's solid waste management program operates primarily through a cooperative arrangement with a consolidated county unit system supervised by seven district sanitarians strategically located through the state.

VII. WASTEWATER

A. Introduction

The Division of Environmental Management of the North Carolina Department of Natural and Economic Resources exercises principal program responsibilities for North Carolina's wastewater pollution control and abatement program. The U.S. Environmental Protection Agency has delegated to the state of North Carolina certain portions of the federal water pollution control program, such as the review authority over plans and specifications for facility construction projects, authority for operation and maintenance manual preparation, review authority over change orders and primacy over the National Pollution Discharge Elimination System (NPDES) permit program.

Of the 372 municipal facilities in the state, 85 were not in compliance with secondary standards and 173 were not in compliance with Water Quality Standards as of June 30, 1976. There are 822 non-municipal facilities in the State of North Carolina and 155 were not in compliance with BPT standards and 185 were not in compliance with Water Quality Standards. Major emphasis in the future is to be placed in both of these areas so as to obtain compliance or a schedule for the attainment of compliance for those sources which are still currently in violation. Maintenance of compliance for all other sources will also continually be addressed.

The Division of Environmental Management's Water Quality Section completed all Phase I planning during Fiscal Year 1976 and initiated substantial revisions for Basin Planning. The state also has met Phase II and Areawide Planning objectives on schedule, and although Water Quality Standards and Classification objectives were not fully met during Fiscal Year 1976, the necessary field work has been completed.

The State of North Carolina has been awarded over $79 million in grant allocations during Fiscal Year 1976 by EPA for 35 Step I, 25 Step II and 16 Step III municipal facility construction grants. Program objectives were mostly achieved during Fiscal Year 1976 even though the specific numbers of grants that were planned to be awarded were not met due to the staff's over-projections and the fact that 201 plans preparations and revisions had taken longer than anticipated.

The Water Quality Section achieved its objectives for the primary station monitoring network during Fiscal Year 1976, but because of budget constraints, revisions of directions, and over-projections, the outputs planned for Biological Monitoring, Estuary Areas, and Lakes and Reservoirs were not achieved. Reconnaisance schedule inspections of the municipal facilities in the area of compliance monitoring exceeded the projections that were made by 21 percent while inspections for non-municipal facilities were exceeded by 29 percent during Fiscal Year 1976.

Wastewater treatment plant operators are expected to comply with a mandatory certification program after 17 years existence as a voluntary program. A Wastewater Treatment Plant Certification Commission was created in July, 1969 (General Statutes 90A; 143B-300) and is composed of seven members appointed by the Secretary of the Department of Natural and Economic Resources with the approval of the Environmental Management Commission. Classification of wastewater treatment plant facilities in

North Carolina is made with regard to the size of the facility, the nature of the wastes to be treated or removed from the wastewater, the treatment process to be employed, and the degree of skill, knowledge and experience that the operator of the wastewater treatment facility must have to supervise the operation of the facility. Grades of certification for wastewater treatment plant operators correspond to the classification of wastewater treatment facilities.

B. Workforce Profile

The Water Quality Section within the Division of Environmental Management has principal program responsibilities within the Division for North Carolina's water quality management program. The Water Quality Section has four branches which include:

(1) Municipal Facilities Construction Branch: Responsible for the State Grants Program, 201 plan review, 201 grants (step I & II certifications), and the environmental review program;

(2) Water Quality Operations Branch: Responsible for the field offices, monitoring programs and for carrying out special studies;

(3) Permits and Engineering Branch: Responsible for NPDES permits, State non-discharge permits, plan reviews, special engineering projects, 401 certifications, and 201 Step III plan certifications;

(4) Operator Training and Certification Branch: Responsible for continuing operator training, the annual school, operator certifications and the laboratory training program.

The Water Quality Section also receives technical assistance from a Water Quality Council and program support from the Division of Environmental Management's Enforcement, Laboratory, and Planning and Management Sections. The Water Quality Section also has personnel stationed in the Department's seven field offices. Field offices carry out investigations, surveillance, network monitoring, technical assistance and informal enforcements for the Division of Environmental Management. The Division's Laboratory Section has personnel located in Regional Laboratories in Asheville, Morreville and the Washington Field Offices. Approximately forty percent of the Enforcement Section's activities are devoted to Water Quality Section matters.

The Water Quality Section currently has a total staff of 112 persons of whom 72 are professionals (engineers and scientists), 24 are technicians and 16 are clerks and other supportive personnel. Environmental engineers and chemists predominate the staff professionals currently employed by the Water Quality Section. The following table depicts the total number of personnel currently employed for waste water pollution control and abatement program activities by the Division of Environmental Management's Water Quality Section.

TABLE XVI

NORTH CAROLINA DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES

Division of Environmental Management
Water Quality Section
Current (1976) Staffing Level

Position	1976
Engineer	45
Scientist	27
Technician	24
Other	16
TOTAL	112

Of the "Engineer" positions depicted in Table XVI, all forty-five are classified as environmental engineers. In reality, environmental engineers employed by the Water Quality Section are sanitary engineers. At the entry level, environmental engineers are required to have backgrounds in sanitary engineering or to have taken sanitary engineering options while in engineering school. They are also required to have at least one year of on-the-job experience or other similar experience as an environmental engineer prior to their employment by the State of North Carolina. Most of the engineers currently employed by the Water Quality Section are licensed professional engineers. Most of the Water Quality Section's engineers have the educational backgrounds to become licensed professional engineers if they are not so licensed.

Environmental research specialists (3), environmental chemistry consultants (9), chemical analysts (11) and extension-education and training specialists (4) are all classified in the previous table as degreed "scientists". An environmental research position requires an aquatic biology degree or a similar biology degree at the entry level. Other degrees that may qualify an applicant for a position in this classification include wildlife biology, zoology or forestry. Environmental research specialists must also have at least one year of practical experience prior to their being hired by the Water Quality Section. An environmental chemistry consultant position requires a bachelor degree in chemistry, whereas analytical chemists may not have majored in chemistry but are required to have taken 16 quarter hours of chemistry in college. Extension-education and training specialists must be Grade IV waste treatment plant operators, have had four to six years of such experience as operators, and have bachelor degrees in scientific areas.

The Water Quality Section employs as "technicians", 12 environmental engineering technicians, 10 environmental monitoring technicians, and two environmental management technicians. An environmental engineering technician position requires a technical school level associate degree in either engineering or engineering technology plus three years of practical experience gained possibly through on-the-job training. Environmental monitoring technicians must have a high school education with some knowledge of field chemistry procedures. Many persons currently employed by the Water Quality Section in this position have associate degrees in engineering and some have four-year zoology and biology degrees, as they are unable to be placed at the present time in professional positions. The Water Quality Section does not employ either sanitarians or laboratory technicians.

Division of Environmental Management administrative officials stated that the Division's personnel are recruited through the Department of Natural and Economic Resources Personnel Division. The Division does not directly recruit personnel through the State Merit System as the Department of Health Services does.

North Carolina has a total of approximately 1,700 classified wastewater treatment plants which are rated on a scale of 5 to 25 points with a Class I facility being the lowest level and a Class IV facility being the largest plant facility. North Carolina legislation requires that each wastewater treatment plant must have a least one responsible certified operator in charge. The following is an approximate listing of the total number of wastewater treatment plants in North Carolina by Class:

Class I	918	(54%)
Class II	612	(36%)
Class III	85	(5%)
Class IV	85	(5%)
TOTAL	1,700	

In 1970, North Carolina had 738 certified wastewater treatment plant operators on record. The Operator Training and Certification Branch recently completed a renewal program and tabulated a list of active operators on file. As of January 1, 1976, a total of 3,296 operators have been certified in the State of North Carolina in all four Grades. However, only 1,778 operators are currently active (about 50%) in that they have paid their $5 annual certification or recertification fee. The following table depicts an approximate listing of the total numbers of wastewater treatment plant operators that are currently active as of January 1, 1977.

TABLE XVII

STATE OF NORTH CAROLINA

Certified Wastewater Treatment Plant Operators

Classification	1976
I	978
II	622
III	89
IV	89
TOTAL	1,778

Most of North Carolina's wastewater treatment plants are of the Class I or II type. Approximately 1,100 wastewater treatment plants remain to be classified since, until 1974, motels and county schools were under the jurisdiction of the State Board of Health and not under the jurisdiction of the Division of Environmental Management. Larger treatment plants (Class IV) may have as many as 50 persons working at the plant. Class I and II facilities do not have persons to operate the facilities full-time. Operators at these facilities often run a few process control tests, keep the grounds mowed and ensure the chlorinator is working. Daytime workers at the larger treatment plants include workers for sludge disposal activities and laboratory workers. A Class I and II facility in North Carolina usually will have at least one certified operator, whereas a Class III plant will have as many as five to ten employees. A Class IV plant may have as many as twenty to twenty-five employees including shift workers working at the treatment plant. A certified Grade IV treatment plant operator at a Class IV facility usually is the chief administrator of the plant, whereas a Grade I operator may be a laborer.

C. Workforce Projections

Workforce Projections for wastewater program activities for the Water Quality Section are based upon professional judgements of the Section's and the Division of Environmental Management's senior level administrative officials. The North Carolina General Assembly is currently meeting in its regular biennial session to consider the budget request for Fiscal Years 1977 and 1978, and is reflected in the Division Program Plan for FY 76-77. Water Quality Section officials only expect approval from the Advisory Budget Commission for the hiring of two additional extension-education and training specialists for the next two years (Fiscal Years 1977 and 1978). However, expanded program grants are expected to increase staffing levels well beyond the FY 76-77 level. Officials project that an additional five environmental research specialists will be recruited to increase the capabilities of the Section's Biological Monitoring Program for Fiscal Years 1979-1980. In addition, eleven engineers, six technicians, five scientists and six other positions are anticipated by 1982. Thus, the Water Quality

Section is expected to increase in staffing level by thirty to forty positions by 1982. Of this number, fifteen will be added by July 31, 1977. The Division's Planning and Management Section received approval for additional staff for its air and water quality functions. The Planning and Management Section's Water Planning Unit develops river basin framework and comprehensive plans, water quality management plans, an areawide waste treatment management plan and capacity-use area studies. The Planning and Management Section is expected to increase its Data Management Unit staffing level by three positions in Fiscal Year 1977 and by one data management position in Fiscal Year 1978. The Unit is expected to undergo a similar increase during Fiscal Years 1979 and 1980. The Division's Laboratory Section is expected to acquire an additional eight to nine persons for staff laboratory support activities in the next five years. Based upon projections supplied by Water Quality Section program personnel, the following table depicts possible staffing level increases for the next five years for the Division's Water Quality Section.

TABLE XVIII
NORTH CAROLINA DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES
Division of Environmental Management
Water Quality Section
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	45	54	54	56	56	56	n/a	5%
Scientist	27	30	31	33	37	39	n/a	7%
Technician	24	25	27	28	29	30	n/a	5%
Other	16	18	18	19	21	22	n/a	7%
TOTAL	112	127	130	136	143	147	5%	5%

Water Quality Section officials state that there has been no change in staffing levels from Fiscal Year 1975 to Fiscal Year 1976. Turnover for the Water Quality Section is estimated as having been as high as ten percent annually in the past few years on the average. For 1976, the average annual turnover rate is estimated at five percent for the Water Quality Section's total staff. The Water Quality Section's staffing level has not substantially increased in size since 1973 when the Section increased by 55 percent.

As additional wastewater treatment plants are constructed through the Construction Grants Program and the plants increase in chemical, mechanical and biological complexity, more complex plants will require well-trained operators to operate the plants efficiently. The Division of Environmental Management has estimated that at the present time there are at least 2,000 operators requiring training and approximately 3,000 additional operators who will require training and certification by 1980. The State requires that each plant must have a certified operator in responsible charge of the plant and the Division measures the training level achieved by plant operators through the certification program. Program officials maintain that the certification program deserves increasing attention and resources over the next five years.

It is evident that the plants which are currently being constructed through the Construction Grants Program can only function as efficiently as the operator's ability to give the facilities the proper attention they require. The Division of Environmental Management has found that one of the basic problems faced concerning operator education is the fact that most operators are paid low salaries and often have a low level of education. If waste treatment plant operators are to receive additional pay increases and incentives, communities, industries and other owners of waste treatment facilities must increase resource commitments to both the operators and the facilities.

It is anticipated by Water Quality program officials that there will be an annual increase of about 550 Grades I and II certified operators and an additional forty to fifty Grades III and IV operators each year. Approximately eighty percent of the total by 1982 is expected to be Grades I and II operators and twenty percent Grades III and IV operators. It is also anticipated that two-thirds of the 3,296 operators who have been certified but of whom only 1,778 are still currently active, will be actively certified by 1982. Approximately 760 operators require upgrade training each year in North Carolina. Assuming that growth in the numbers of certified operators occurs at a constant rate over the next five years, the following table depicts estimated projections for active certified wastewater treatment plant operators.

TABLE XIX

North Carolina Wastewater Treatment Plant Operators
Workforce Projections to 1982 (est.)

Classification	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
I	978	1,303	1,628	2,278	2,503	2,928	20%	25%
II	622	847	1,072	1,297	1,522	1,747		23%
III	89	111	134	156	177	200		18%
IV	89	112	133	155	178	199		18%
TOTAL	1,778	2,373	3,967	3,731	4,480	5,074		23%

D. Training and Certification

Training for staff of the Water Quality Section is considered by State officials to be presently inadequate. Training that has been offered for staff has been of an informal nature and infrequent. The Division of Environmental Management has recognized that this training deficiency exists and has proposed in its Fiscal Years 1977-1978 biennial budget request that the North Carolina General Assembly provide funding to correct the problem. The Division requested in the budget that $12,000 dollars be provided to the Water Quality Section over the next two years for a program to provide in-house training for staff of the Water Quality Section through contractual and other arrangements. The training would be presented in a formalized program and would be specifically designed for environmental engineers, chemists, biologists, technicians and monitoring personnel. Services of commercial firms with particular expertise in the environmental field would be utilized, as would training courses that are currently available at local universities and/or state or federal agencies. The training courses that have been proposed to be developed would be for three days duration and would be oriented for the specific disciplines referred to above. Staff training would thereby enable Water Quality Section personnel to keep up with new developments in the water pollution control field and would also provide needed training for managerial and for office skills.

When personnel of the Division of Environmental Management are first recruited, they receive orientation training on the State and Federal laws, and in Division rules, regulations and policies. Division administrative officers consider their technical staff to be as well-trained as any other wastewater pollution control and abatement regulatory agency in the nation. The State provides opportunities for its professional technical personnel to receive Master's Degrees through a State-paid tuition program. The State also provides a leave of absence with pay for any staff member who is receiving long-term training in a job-related area.

New personnel who are hired by the Division for water quality program operations in an engineering capacity are expected to perform at the expected level of competency after one year of employment with the Division. It is usually not difficult for the Water Quality Section's engineers to rapidly acquaint themselves with the duties that are expected of them to be able to perform, as the Department of Natural and Economic Resources requires that an engineer have several years of experience prior to being hired by the Division.

The North Carolina Water Pollution Control Association conducts an Annual School for wastewater treatment plant operators held at the University of North Carolina in Chapel Hill during May. The Wastewater Treatment Plant Operators Certification Commission cooperates with the Association and approves of this school in order to ensure that the level of instruction is maintained and that the courses are relevant to current wastewater treatment plant needs. The Annual School is designed to last for one week and to offer about twenty-six hours of instruction for each of the four grades of operator certifications. Instructors for the Annual School are recruited from the Association's membership roster.

Training for Grades II and IV operators has been limited until recently to the instruction provided at the Annual School which approximately 400 operators attend each year. Regional training schools offer training only for Grades I and II operators in the proper maintenance and operation of conventional biological wastewater treatment plants.

Laboratory training schools are also offered for treatment plant personnel in North Carolina. The following is a needs list of training desired by North Carolina's wastewater treatment plant operators according to a survey of 100 operators conducted by the Division's operator training unit:

(1) Operators are looking for more advanced wastewater treatment courses;

(2) A Regional Grades III and IV school is needed;

(3) Operators desire that advanced treatment plant course be located near their homes and that they preferably be located at community colleges (North Carolina has 57 community colleges);

(4) Advanced training is a dire need of North Carolina's wastewater treatment plant operators, who believe that there currently is a lack of training in this area.

A total of 1,028 persons attended wastewater treatment plant training schools in North Carolina during calendar year 1976. Five hundred and forty-four persons were enrolled at the Regional Schools, 134 participated in the Laboratory Training Schools, 250 persons took the examination during the Annual School and 100 persons participated in the Advanced Wastewater Treatment Seminar and the University of North Carolina's effluent monitoring laboratory course. A total of 678 Grades I and II operators attended the Annual and Regional Schools training sessions in 1976. A total of 540 operators were certified during 1976 in the following Grades:

Grade I	196
Grade II	295
Grade III	32
Grade IV	17
TOTAL	540

Of 163 Grade III and IV operators who took the advanced certification examinations, only 49 passed.

For Fiscal Years 1977 and 1978, the Operator Training Unit expects to recruit an additional two extension-education and training specialists. With these two additional training specialists, it is estimated that the numbers of Regional (including Laboratory) Training School sessions that can be held will increase from a total of 34 during 1976 to 43 by 1978. They will thus be able to convert from two partial and three full training school sessions to five partial and 7 full (all four Grades) school training sessions and, therefore, can handle 678 Grades II and III operators.

E. Career Potential

Water Quality Section officials could not foresee any new types of careers rising from the development of new water pollution control techniques or technology in the next five years, but note that the technology is changing so rapidly that some new career categories could evolve. A career potential for personnel for water quality planning expertise may develop over the next five years within the Division of Environmental Management because program officials feel that the area has become a very specialized field in which few are qualified.

Program officials foresee a dire need in the next five years for more competent and better trained wastewater treatment plant operators as more and more facilities become upgraded and operational as a result of the Construction Grants Program (Section 109 (b): PL 92-500). Officials feel that EPA has relied too heavily on the Department of Labor and the Department of Health, Education and Welfare for the development of training programs, as the need for additional training is quickly surpassing the training resources currently available.

F. Conclusion

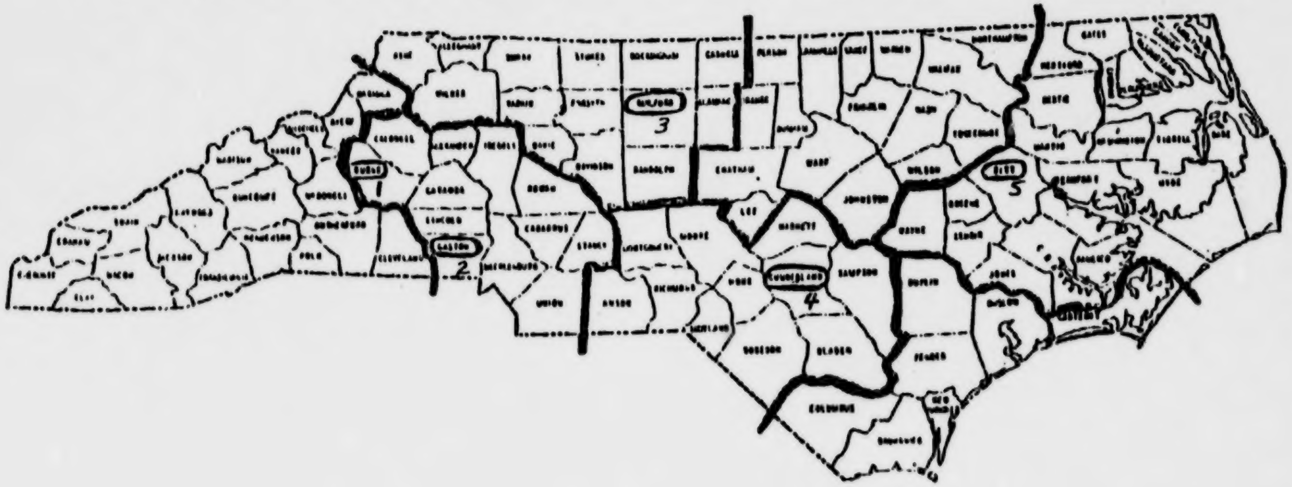
North Carolina's wastewater pollution control and abatement program has always closely tracked EPA priorities. Program officials feel that EPA's highest priorities at the present time are the construction grants program, the issuance of permits and enforcement activities. If any funds remain, the second priorities are operator training and the development of a workforce program. North Carolina strongly puts its emphasis on closely paralleling EPA program directions as over one-half of the Division of Environmental Management staff salaries are supported by EPA funds. It is significant that the Advisory Budget Commission which reviews Department budget requests before they are submitted to the North Carolina General Assembly, approved a request for two additional extension-education and training specialists for supporting operator training needs in the next two years. The two positions receiving such approval were out of a total Water Quality Section budget request for the next two fiscal years for about 40 positions. The Federal Public Law 92-500 legislation provided approximately $24 billion for construction of wastewater treatment plants but provided very little for the training of operators to run these plants.

Program officials feel that they are presently performing an inadequate job of committing funds to the Construction Grants Program and they are unable to recruit personnel to perform monitoring inspections of the construction activities underway or being completed. At least one person needs to be recruited to spend four days in the field, inspecting grant program facilities and one day writing reports. In the future, the Water Quality Section intends to submit requests to the General Assembly for authority and funds to recruit personnel for such an effort.

The Water Quality Section needs to improve its bio-monitoring program so that the State has a better capability of handling toxic substances entering the state's streams and rivers. Additional personnel are also required so that the Section's engineers can concentrate more effort on permit writing so better water quality standards can be developed.

Figure 4

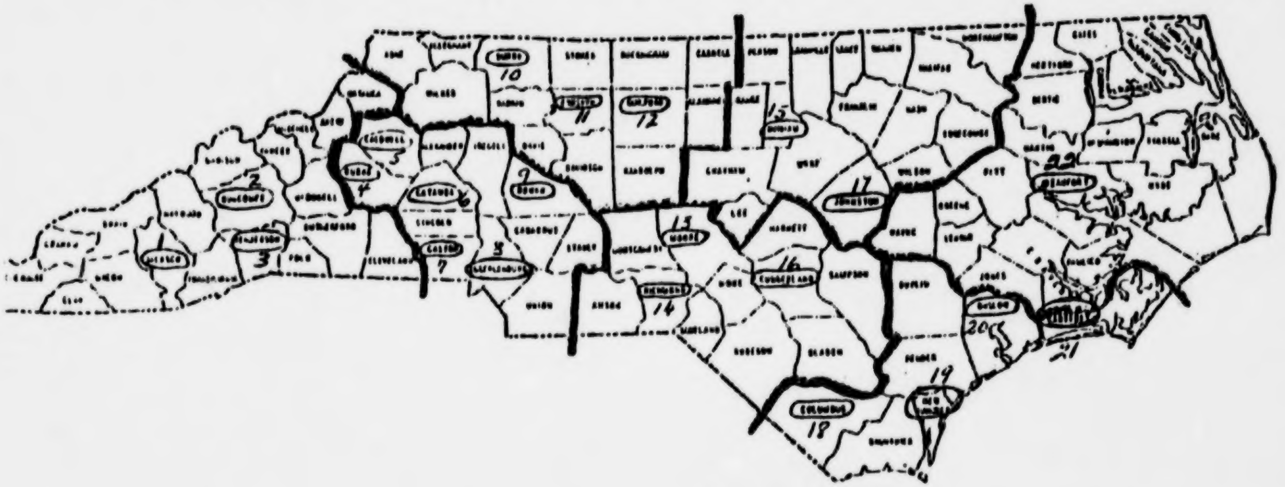
Proposed Locations for Operator Training and Certification Laboratory Schools - 1977



LOCATION	SCHOOL NAME
1	Western Piedmont Community College, Morganton - Spring, 77
2	Gaston College, Dallas - January, 77; Fall, 77
3	Guilford Technical Institute, Greensboro - Summer, 76; Fall, 76; Spring, 77
4	Fayetteville Technical Institute, Fayetteville - Fall, 76; Spring, 77
5	Pitt Technical Institute, Greenville - Fall, 76; Fall, 77

Figure 5

Proposed Locations for Operator Training and Certification Regional Schools - 1977



LOCATION	SCHOOL NAME
1	Southwestern tech., Sylva - Spring, 77
2	Asheville-Buncombe Tech., Asheville - Fall, 76
3	Blue Ridge Tech. Inst., Hendersonville - Winter, 76
4	Western Piedmont Comm. Coll., Morganton - Winter, 76
5	Caldwell Comm. Coll., Lenoir - Fall, 76
6	Catawba Valley Tech., Hickory - Fall, 77
7	Gaston College, Dallas - Fall, 76
8	Central Piedmont Comm. Coll., Charlotte - Winter, 77
9	Rowan Tech. Inst., Salisbury - Fall, 76
10	Surry Comm. Coll., Dobson - Fall, 77
11	Forsyth Tech. Inst., Winston-Salem - Spring, 77
12	Guilford Tech. Inst., Greensboro - Fall, 76

LOCATION	SCHOOL NAME
13	Montgomery Tech. Inst., Troy - Fall, 76
14	Richmond Tech. Inst., Hamlet - Fall, 76
15	Durham Tech. Inst., Durham - Spring, 77
16	Fayetteville Tech. Inst., Fayetteville - Winter, 76
17	Johnston Tech. Inst., Smithfield - Winter, 77
18	Southeastern Tech. Inst., Whiteville Fall, 76
19	Cape Fear Tech. Inst., Wilmington - Fall, 76; Spring, 77
20	Coastal Carolina Community College, Jacksonville - Fall, 76; Spring, 77
21	Carteret Tech. Inst., Morehead City - Spring, 77
22	Roanoke-Chowan Tech. Inst., Ahoskie - Summer, 76 Fall, 76 - Spring, 77
23.	James Sprunt Tech. Inst., Kenansville - Fall, 76

The Annual School For Wastewater Treatment Plant Operator's Is Scheduled For May 16 - 20, 1977.

VIII. ENERGY

A. Introduction

The State of North Carolina's energy program is located in the Department of Military Affairs, and is entitled the Energy Division. The Energy Division was created by the North Carolina Legislature (GS 143, 143A, Chapter 1253) to provide a central point in the State Government to be charged with the responsibility for the operational and planning aspects of energy management, except where otherwise provided by state law. It was also created to provide the focus for implementation of the state energy policy and the state elements of a national energy policy. At the present time, the Division is primarily concerned with energy allocation, and is equally involved with the Federal Energy Administration's Energy Conservation Program.

Carolina Power and Light Company operates one 821,000 kilowatt capacity nuclear power reactor called the Brunswick Steam Unit 2 at Southport, and is scheduled to begin operations of a second Brunswick Steam Unit in the spring of 1977. The Company has limited authorization to construct another 900,000 kilowatt unit near Raleigh to begin operations in 1984, and three more units are in the planning stages. Carolina Power and Light has ordered three 1,150,000 kilowatt reactors for its South River Plant.

Duke Power Company operates a 1,180,000 kilowatt reactor at Cowans Ford Dam, which is to be fully operational by 1978. It has completed 80 percent of the work on the William B. McGuire Unit 1 at the present time. The plant is the first of two reactors to begin operations in 1978. Duke Power Company has also ordered three 1,280,000 kilowatt units for a Yadkin River site near Mocksville, North Carolina. Duke Power Company considers it to be more expensive to construct a nuclear power plant than a coal-fired plant, but they feel that over the next 30 to 40 years the nuclear reactors will prove cheaper. Company officials state that all their future construction plans have been for nuclear installations.

North Carolina imports most of its coal used to generate electricity, and approximately one percent of its power is obtained from hydroelectric plant sources. About 90 percent of all the coal used in North Carolina is imported and used for electricity generation. The coal used is not necessarily of high grade or low sulfur content.

The Utilities Commission is recognized as the legal authority in North Carolina authorized to determine natural gas rate structuring. The Commission has shown an active interest in developing a better environmental approach to energy usage. It has plans for future North Carolina energy plants, and requires that environmental impact statements are prepared for each plant. As well as being charged with the regulation of rates, the Commission also reviews plans for expansion.

The North Carolina Energy Planning Council was established by the Energy Policy Act, Chapter 877, GS 62-2. The Council was established to recommend energy programs to the Governor and to the North Carolina General Assembly. It serves as the central energy policy planning body of the State and cooperates and communicates with federal, regional, and local agencies in order to establish an effective coordinated energy policy. The Energy Policy Council presently consists of 14 members, including the Chairman of the Utilities Commission, the Secretary of the Department of Natural and Economic Resources, the Commissioner of Agriculture, two members from the House of Representatives, two from the State Senate, and seven from the general public.

B. Workforce Profile

The Energy Division was created in 1974, and developed its own mission statement, which was circulated within the Governor's Office. The Energy Division is principally involved with three major programs, which are:

1) Allocations
    a) The Allocations Section is currently working on a natural gas study in conjunction with other State agencies.
    b) Task force studies are planned with regard to electricity, conservation, and petroleum.
2) Data Collection
    a) Surveys North Carolina manufacturing industries for SIC 20 - 39 to determine consumption patterns for 1974.
    b) Energy problem impact studies are carried out to assess the effects of rising energy prices and fuel shortages on the consumers.
    c) Participates in a natural gas study to define the problem of curtailment in the State, and provides recommendations for the future.
    d) Publishes Energy Consumption in North Carolina, which describes State consumption patterns in broad economic sectors by fuel type.
3) Conservation
    a) The Conservation Branch coordinates energy conservation measures in State government through the Energy Conservation Council. The Council is preparing guidelines for energy efficiency in State government facilities and transportation.
    b) Local programs are coordinated through the Energy Field Agents (100) located in each county.
    c) Develops plans for an Energy Conservation Week (November 2 - 8).
    d) Coordinates programs for business and industry with the Industrial Extension Service of the North Carolina State University and the local Energy Field Agents.

The Energy Division has a staff of 11 persons, including a director. Two persons are assigned to the Research and Data Section and eight persons have been assigned to work on energy conservation. A project director, three analysts and one secretary have been hired to work on the State Energy Conservation Plan. Five temporary personnel were hired under a grant which was applied for by North Carolina, and the authorization for such activities was provided by the passage into law in December of 1975 of the Federal Energy Policy and Conservation Act. The permanent staff of the Energy Division is depicted in the following table.

TABLE XX

NORTH CAROLINA DEPARTMENT OF MILITARY AND VETERANS' AFFAIRS

Energy Division
Current (1976) Staffing Level

Position		1976
Administrator		2
Senior Fuel and Energy Researcher		1
Fuel and Energy Economist		1
Senior Conservation Officer		1
Conservation Officer		1
Senior Allocations Officer		1
Allocation Officer		1
Clerical		3
	TOTAL	11

Duke Power Company's Design Engineering Department and Steam Production Plant Operations Department are the two principal environmental control and abatement components within these utility companies. The Design Engineering Department designs power facilities so as to be able to meet present environmental standards. The Department employs twelve full-time people to conduct these activities. The Licensing Section writes the environmental requirements which are needed to be in compliance, and also submits environmental reports and assessments. The Department's meteorologists work on special projects and perform monitoring tasks to coordinate the functions of both Design Engineering and the Steam Production Plant Operations Department. The reports are to provide the necessary coordination needed in order to perform the required tasks. In terms of educational backgrounds possessed by the Department's staff, the Design Department's environmental group is scientifically oriented and is staffed by aquatic biologists, meteorologists, and several engineers. Many of those on the staff have Ph.D.'s.

The Design Engineering Department's Special Project's group coordinates the preparation of environmental reports. Personnel in this group are mostly college educated, with most having master's degrees, serving as civil engineers, chemists and biologists. The Special Projects group conducts studies on hydrology, dam failures, the capacity of streams, and future installation sites. The Design Engineering Department has a total staff of approximately 800 engineers in all power plant locations, which consists chiefly of civil, mechanical and electrical engineers. The personnel employed in the environmental engineering sections are mostly civil engineers.

The Steam Production Plant Operations Department implements the necessary modifications in order for each plant to meet the environmental regulations. This Department compiles data used by the Design Engineering Department from the power plants.

The Environmental Laboratory operated by Duke Power Company has between 70 and 100 persons engaged in performing field measurements and sanitary analyses. Each plant's chemical section performs its own monitoring activities. The Steam Production Plant Operations Department has over 2,000 employees, but not all are environmentally-oriented.

Duke Power's Power Chemistry Group has six to seven persons in power regulatory job assignments. Educational backgrounds range from bachelor's degrees to Ph.D.'s. The Group has three chemical engineers with bachelor degrees, and all chemical engineers are engaged in working on designs and regulatory work concerning water and air pollution control and abatement. Four chemical engineers work on water pollution problems, and two or more chemical engineers work with a supervisor on air pollution problems.

C. Workforce Projections

The five persons who were hired on a temporary basis with the Energy Division for the Energy Conservation Program will be made permanent employees during 1977, still under a federal grant. In addition, requests have been made by Energy Division officials to gain three more positions during that same year. These positions would include a director, a mechanical engineer for the building phase of the Conservation Program and a secretary/librarian. Officials expect a subsequent moderate staffing increase to 1982, with the expected addition of three to five persons for the Conservation Program.

Duke Power Company has now reached its peak in staffing for environmental work, and it now has excess capabilities. If there is to be any increase in environmental jobs in the next five years, it is likely to be for monitoring activities. By 1980, Company officials project that they will need every environmental person presently on their staff, as several more nuclear plants will begin operation in the next five years. Duke

Power Company has an annual turnover rate of less than five percent. As Duke Power Company is a fairly diverse utility, if an employee is dissatisfied in working in one particular aspect of company operations, he/she can fairly easily transfer to another activity. Growth in the next five years, according to Company officials, is dependent on the regulations that are promulgated by the U.S. Environmental Protection Agency. Approximately one plant technician leaves each week and persons are replaced by part-time students to serve as chart readers. There is unlikely to be an increased demand for technicians in the next five years.

D. Training and Certification

As the Energy Division has no laboratory or technical research employees on its staff at the present time, little additional training is utilized for the staff's activities. If additional needs develop for a specific technical task to be performed, personnel are contracted from the Research Triangle Park Institute.

North Carolina State University has recently been awarded a research grant of over 1.3 million dollars from the U.S. Environmental Protection Agency for the next five years to conduct a project to help assure the environmental soundness of coal gasification. A team of NCSU faculty members will build a pilot coal gasification plant in Riddick Engineering Laboratory, and the plant will be studied to determine ways to avoid discharge of unwanted pollutants to the environment.

Most professionals currently employed by Duke Power Company have received chiefly on-the-job training. Additional training is obtained when they attend Carolina Air Pollution Control seminars, and other seminars and workshops where new ideas are introduced that could potentially affect the operations of their plants. In August 1976, Duke Power Company engineers were sent to a low sulfur coal conference sponsored by EPA at Research Triangle Park in order to learn how to make coal burning corrections. Two persons from the Company's Power Plant Group recently completed master's degrees in chemical engineering and concentrated on learning about specific phases of chemical engineering as it relates to air pollution control and abatement. Another company employee recently completed a master's degree in environmental technology to qualify for stack testing and chemical analysis tasks.

E. Career Potential

Energy Division officials expect a great shift in energy usage by the year 2000 to coal and solar power sources. Several private firms in North Carolina are commercially building solar reflectors at the present time. The Energy Research and Development Administration's Solar Energy Division has selected twelve locations in the United States for possible sites to develop installations to create energy from wind power. One of the sites is located near Boone, North Carolina. At the present time, ERDA has not decided which four of the twelve possible locations currently being monitored for wind strength will actually be selected for the facility. Carolina Solar Equipment Company of Salisbury, North Carolina builds and installs a complete solar power system for homes. If such systems become commercially feasible in the next few years, it could produce a transfer in the workforce from one construction field to another.

By the 1980's, Duke Power Company officials project that they will not hire many more engineers strictly for environmental related work in their Design Engineering Department. Duke Power Company has already reached its peak in recruiting personnel to fill environmental workforce needs for studies and design, and few additional design engineers are expected to be recruited in the next five years. Duke Power sources stated that they could not project how many more personnel will be needed for monitoring activities, but they expect a substantial increase in this area.

F. Conclusion

Energy Division officials expect moderate workforce growth in the energy field on the state level in the next five years, especially for the implementation of the State Energy Conservation Plan, and possibly for the weatherization of homes. However, both programs are of relatively short duration, and not supported by state funding.

Duke Power Company officials projected that ten power plant units will become operational between 1976 and 1986. Company officials expect all of their future growth in power generation to be accomplished by nuclear power reactors. It takes approximately ten years to build a power plant, according to Company officials, and to sell the power generated. Duke Power employs a total of 11,806 employees; 8,077 are assigned to Company Operations, and the other 4,000 to power plant construction activities. Duke Power presently has 90 operating plants. Five plants (four of which are nuclear) are currently in the design and construction phases. Duke Power is a unique utility in that it designs, constructs and operates its own plants, and does very little outside contracting.

Note: As of February 22, 1977, the Energy Division has by legislative action been transferred to the North Carolina Department of Commerce. Functions, activities, staffing levels and projections have not changed as a result. A fifteenth member has been added to the Energy Policy Council: the Secretary of the Department of Commerce.

U.S. ENVIRONMENTAL PROTECTION AGENCY

RESEARCH TRIANGLE PARK, NORTH CAROLINA

ACKNOWLEDGEMENT

Valuable assistance and support for this project were provided by numerous officials of the Environmental Protection Agency in Research Triangle Park. Within the Office of Research and Development, Mr. Norman E. Childs of the Support Service Office was particularly helpful with the coordination of data gathering within the EPA facilities. Those that provided the information required in support of this project include Dr. John Knelson, Director of the Health Effects Research Laboratory; Dr. Alfred Ellison, Deputy Director of the Environmental Sciences Research Laboratory; Dr. Thomas Hauser, Deputy Director of the Environmental Monitoring and Support Laboratory; and Dr. Norbert Jaworski, Deputy Director of the Industrial Environmental Research Laboratory. No less valuable was the assistance of Mr. Ron Campbell, Assistant Director of Program Operations of the Office of Air Quality Planning and Standards (OAQPS) and Mr. Ron Townsend, Project Officer of the Manpower Technical Information Branch of OAQPS.

U.S. ENVIRONMENTAL PROTECTION AGENCY
Research Triangle Park, North Carolina

Introduction

Within the Research Triangle Park (RTP) complex are several components of the U.S. Environmental Agency. Taking place within this complex are numerous activities carried out in support of environmental protection, such as research, standards development, technical assistance and training.

The Office of Research and Development (ORD) of EPA provides research related to standards setting processing, determing short- and long-range effects of pollutants, monitoring pollutant concentrations in the ambient environment, and ensuring the availability of pollution control methods and technology. Four of ORD's fifteen laboratories are located in the Environmental Research Center at Research Triangle Park. These four laboratories and the ORD offices of which they are a part are as follows: (see attached organizational chart)

1) OFFICE OF HEALTH AND ECOLOGICAL EFFECTS:
   Health Effects Research Laboratory
2) OFFICE OF AIR, LAND AND WATER USE:
   Environmental Sciences Research Laboratory
3) OFFICE OF ENERGY, MINERALS AND INDUSTRY:
   Industrial Environmental Research Laboratory
4) OFFICE OF MONITORING AND TECHNICAL SUPPORT:
   Environmental Monitoring and Support Laboratory

The Support Service Office of ORD serves as a liaison for the ORD-RTP research community and directs support activities. This Office provides such services as information dissemination and administrative support for the ORD-RTP laboratories.

The EPA Office of Air Quality Planning and Standards (OAQPS) is also located in Research Triangle Park. This Office has the responsibility of developing air pollution standards as required by the Clean Air Act of 1970. OAQPS is responsible for recommending standards for air quality and for setting emission standards for new plants and hazardous pollutants. This Office is also responsible for overseeing the activities of the Air Pollution Technical Information Center and the Air Pollution Training Institute.

The Office of Administration provides supportive services for the EPA facilities in the area, which constitute the largest EPA field organization outside Washington, D.C. Also providing supportive services to these EPA facilities are the Financial Management Division and the National Computer Center.

The total approximate staffing level for permanent full-time employees within Research Triangle Park is depicted below.

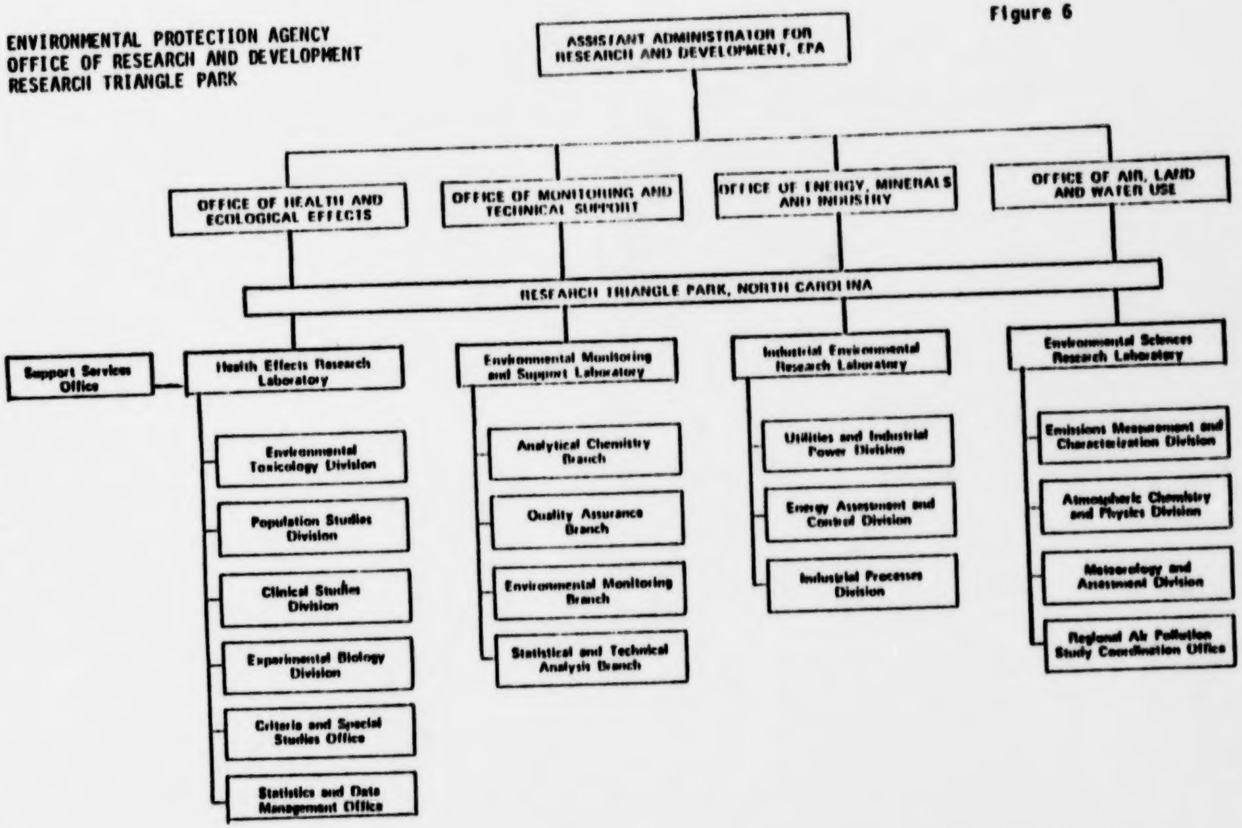
Component	1976*
OFFICE OF RESEARCH AND DEVELOPMENT	
Health Effects Research Laboratory	252
Environmental Sciences Research Laboratory	103
Industrial Environmental Research Laboratory	88
Environmental Monitoring and Support Laboratory	90
Support Service Office	5
OFFICE OF AIR QUALITY PLANNING AND STANDARDS	289
OFFICE OF ADMINISTRATION	143
FINANCIAL MANAGEMENT DIVISION	17
NATIONAL COMPUTER CENTER	24
TOTAL	1,011

*Figures do not include contracted personnel

The following pages present more detailed descriptions of the major EPA technical operations at Research Triangle Park. Laboratories of the Office of Research and Development will first be presented, followed by the Office of Air Quality Planning and Standards. In these reports, focus is placed upon current and projected (five-year) workforce levels and education/training activities.

Figure 6

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
RESEARCH TRIANGLE PARK


ASSISTANT ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT, EPA
OFFICE OF HEALTH AND ECOLOGICAL EFFECTS
OFFICE OF MONITORING AND TECHNICAL SUPPORT
OFFICE OF ENERGY, MINERALS AND INDUSTRY
OFFICE OF AIR, LAND AND WATER USE
RESEARCH TRIANGLE PARK, NORTH CAROLINA
Support Services Office
Health Effects Research Laboratory
Environmental Toxicology Division
Population Studies Division
Clinical Studies Division
Experimental Biology Division
Criteria and Special Studies Office
Statistics and Data Management Office
Environmental Monitoring and Support Laboratory
Analytical Chemistry Branch
Quality Assurance Branch
Environmental Monitoring Branch
Statistical and Technical Analysis Branch
Industrial Environmental Research Laboratory
Utilities and Industrial Power Division
Energy Assessment and Control Division
Industrial Processes Division
Environmental Sciences Research Laboratory
Emissions Measurement and Characterization Division
Atmospheric Chemistry and Physics Division
Meteorology and Assessment Division
Regional Air Pollution Study Coordination Office

U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF RESEARCH AND DEVELOPMENT

I. Health Effects Research Laboratory

A. Introduction

The Health Effects Research Laboratory (HERL) at Research Triangle Park is one of the four laboratories under the Office of Health and Ecological Effects of the Office of Research and Development. This Laboratory identifies and evaluates the effects of pollutants on human health through epidemiological and clinical studies. These studies address problems in air pollution, non-ionizing radiation, environmental carcinogenesis, and the toxicology of pesticides and other chemical pollutants. The Laboratory develops and revises air quality criteria documents on pollutants for which national ambient air quality standards exist or are proposed. It provides the data for the registration of new pesticides or proposed suspension of those already in use. Research on hazardous and toxic materials is carried out, as well as developing and improving methods used for health effects monitoring and analysis.

HERL provides resources in support of the Regional and Program offices of EPA. This assistance is often in the form of testimony in court hearings and in the preparation of affidavits to assist in the enforcement of environmental standards.

Most of the HERL facilities are located in Research Triangle Park, although the Laboratory has small satellite facilities in Chapel Hill, North Carolina and Wenatchee, Washington. Almost two-thirds of the Laboratory's budget is expended for contracts, grants, and interagency agreements which complement the in-house research program which is conducted on-site by HERL employees.

B. Workforce Profile

The Health Effects Research Laboratory is functionally divided into three supportive offices and four divisions which are responsible for the conduct of the laboratory's technical work. The three offices and their primary responsibilities are:

> Program Operations Office: Responsible for performing a variety of administrative and program management duties for all components of the Health Effects Research Laboratory. Provides all administrative assistance and information necessary for program planning and coordination.
>
> Statistics and Data Management Office: Provides statistical, mathematical and computer competence to all facets of the laboratory.
>
> Criteria and Special Studies Office: Develops criteria and state of the art documentation for environmental pollutants. Issues and revises air quality criteria on pollutants for which national ambient air quality standards exist or are proposed. Assesses socio-economic impact of the health effects of environmental pollutants. Serves as the focal point and coordinates activities of the Office of Research and Development in its function as the World Health Organization Collaborating Center on Air Pollution Control.

The four divisions and their principal functions are as follows:

> Environmental Toxicology Division: Conducts research, utilizing laboratory animal species as models, to provide data necessary for the assessment of the hazard to human health of exposures to various environmental pollutants, including pesticides and toxic substances, alone and in combination. The Division develops,

evaluates and improves analytical chemical methods for direct and indirect measurement of exposures to pesticides and toxic substances and conducts a quality assurance program to ensure the accuracy of pesticides and toxic substance analytical data derived internally, from other EPA laboratories, from contractors, and from state and local laboratories.

Population Studies Division: Designs, conducts, analyzes and reports on epidemiological studies of human populations. Serves as the technical resource within the Agency for activities requiring expertise in the area of health effects of environmental pollutants.

Clinical Studies Division: Conducts human and animal studies under controlled conditions to detect and define effects of environmental pollutants on human health. Verifies in humans or investigates in suitable animal systems correlative epidemiological findings. Develops or improves existing methodology for application to human health effects laboratory of field studies. Serves as the technical resource within the agency for activities requiring expertise in the area of human or animal laboratory studies.

Experimental Biology Division: Conducts and manages biological research to detect, define, and quantify the effects of environmental pollutants, singly or in combination. Studies the effects of air pollutants and ionizing and non-ionizing radiation. Plans and conducts special studies in non-ionizing radiation dosimetry and the radiation absorption characteristics of living tissue. Provides professional and technical support services to the Health Effects Research Laboratory's intramural research program by obtaining or producing research animals, maintaining animals on experimentation, and operating a centralized animal care facility.

The Health Effects Research Laboratory with its 252 permanent staff has the greatest mix of professions and is the largest of the laboratories of the Office of Research and Development at Research Triangle Park. The following table depicts the current (1976) workforce level for permanent full-time personnel at the laboratory.

TABLE XXI

RESEARCH TRIANGLE PARK

Health Effects Research Laboratory
Current (1976) Staffing Level

Position	1976
Administrator	13
Medical Doctor	9
Veterinarian	7
Engineer	16
Chemist	39
Biologist	22
Microbiologist	7
Health Scientist/Epidemiologist	11
Physical Scientist	11
Statistician/Computer Programmer/ Mathematician	26
*Other Professional	23
Engineering Technician	15
Biological Aide/Technician	24
Physical Science Technician	1
Clerical	28
TOTAL	252

*Includes medical technicians, pharmacologists, physicists, economists, psychologists and physiologists.

In addition to those administrators depicted in the previous table, 35 persons listed in the other categories also perform administrative functions. These include three engineers, nine chemists, four biologists, three health scientists/epidemiologists, five physical scientists, three medical doctors, three veterinarians, four statisticians/computer programmers/mathematicians, and one other professional.

The Health Effects Research Laboratory also employs temporary and part-time personnel, the number of which varies from month to month. During July 1976, the laboratory employed five full-time temporary personnel, 49 students under three programs, ten professors and medical doctors under federal interagency transfer agreements and one temporary handicapped person.

C. Workforce Projections

Dr. John Knelson, director of the Health Effects Research Laboratory, projected a need for 140 additional professional personnel for the next five year period. During Fiscal Year 1976, the laboratory expected to be over its authorized ceiling of permanent full-time staff. Senior laboratory sources projected that the laboratory will have the greatest need and the most difficulty in recruiting medical doctors. The Health Effects Research Laboratory has recently experienced a high rate of turnover of 15 percent during 1975 resulting from personnel anxiety created by the recent reorganization. The average annual turnover rate is usually much lower (6 percent). The workforce level of permanent staff has significantly declined at the laboratory due to the ceiling placed on the Office of Research and Development by the Office of Management and Budget (OMB). In 1975, the laboratory's staffing level consisted of 292 permanent Civil Service personnel and it has subsequently declined to 255 as of November 1976.

According to senior laboratory officials, the Health Effects Research Laboratory needs the following additional professional personnel in order to adequately perform its mission over the next five years.

Toxicologist/Pharmacologist/Pathologist	50
Analytical Chemist	20
Biochemist	30
Epidemiologist	20
Medical Doctor	20
TOTAL	140

Laboratory officials maintain that the new Toxic Substances Control Act (TOSCA) could have a significant impact on staff growth over the next five years. Although no specific workforce projections were available, sources indicated that the laboratory may need to double its staff if it acquires research responsibilities resulting from TOSCA. Additional toxicologists, analytical chemists, biochemists, epidemiologists and medical doctors would be needed to conduct the research required by the Act.

D. Training and Certification

Selected professionals in the Health Effects Research Laboratory attend long-term training programs for up to one year at universities throughout the country. Sources indicate that no more than one or two professionals are involved in this program at any one time. Professional employees are encouraged to attend classes at local universities during or after working hours. Staff professionals participate in graduate level training programs offered in the technical, professional and management areas. At the Office of Administration's Training Institute, many non-professional staff locally attend courses offered in such areas as speed reading, basic science and mathematics, technical writing and memory development. Employees participate in a wide variety of training programs and laboratory officials estimate that nearly all staff personnel have attended some form of training, including those at professional and subprofessional levels.

Many professionals currently employed by the Health Effects Research Laboratory are also faculty members at local universities in the Research

Triangle Park area. A two-way flow of training capability exists between the laboratory and the universities in the area, and laboratory officials stress that most of the current staff professionals probably would not work with the government if they could not maintain ties with the local academic community. Research Triangle Park is considered to be the largest concentrated area of scientists and engineers holding advanced degrees in the United States.

E. Career Potential

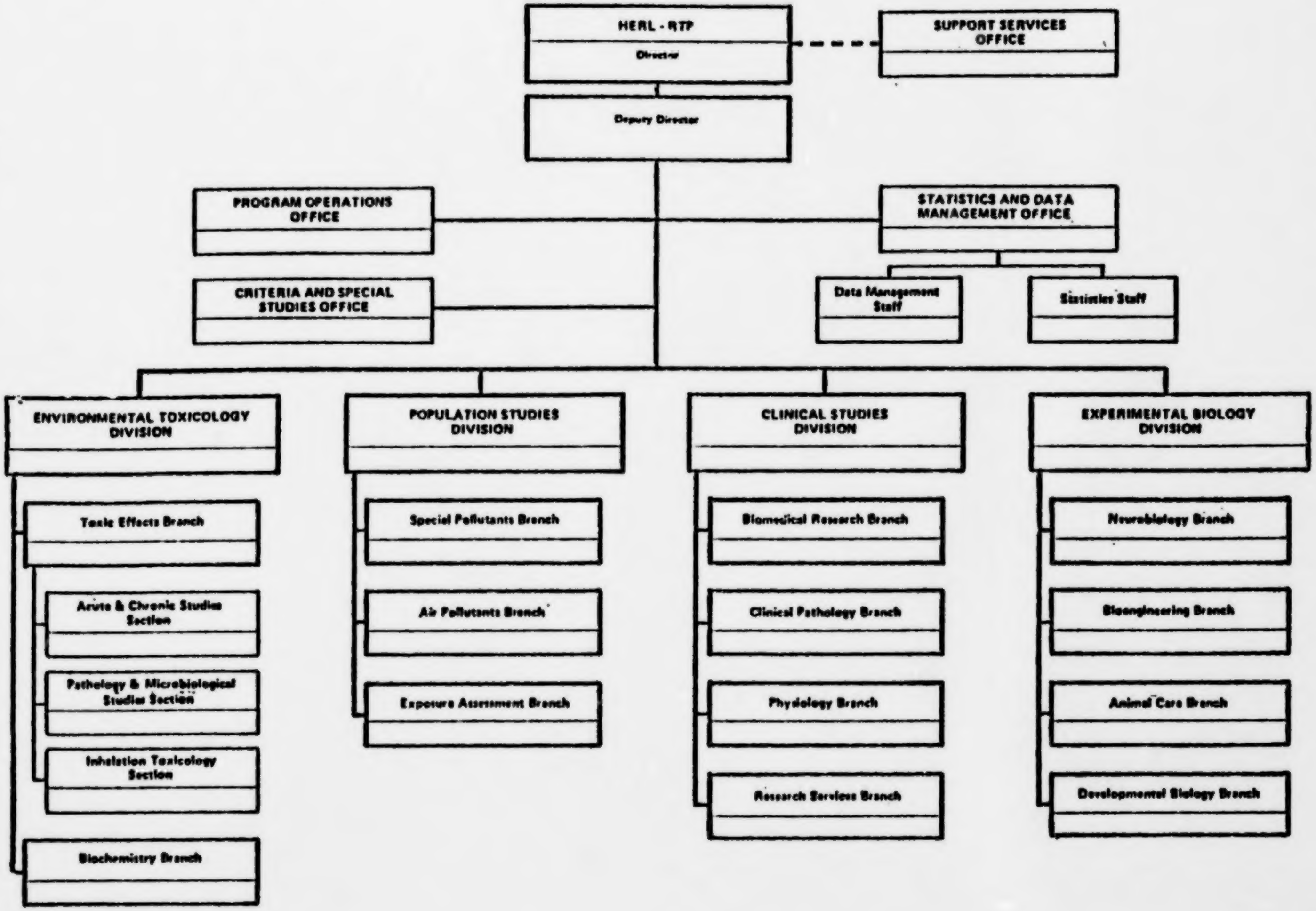
Senior laboratory officials were unable to identify any new or emerging fields that have career potential in the next five years; however, if the Health Effects Research Laboratory acquires research responsibilities as a result of the Toxic Substances Control Act, it is likely that scientists such as microbiologists with expertise in toxicology will be in demand. Senior level laboratory sources have indicated that they are willing to recruit inexperienced medical doctors and train them in environmental medicine, as medical doctors with related research experience are not readily available.

F. Conclusion

If present personnel ceilings remain in effect for the Health Effects Research Laboratory over the next five years, very little growth is projected for this laboratory. The Toxic Substances Control Act possibly could impact laboratory staffing levels if research responsibilities resulting from the Act are attained. More of the laboratory's work is likely to be performed extramurally if the staffing level remains at the present level. If the hiring ceiling is lifted and the laboratory is delegated responsibilities related to the new Act, laboratory workforce growth is likely to occur. Career potentials are likely to be best for medical doctors, epidemiologists, analytical chemists, toxicologists, pharmacologists and pathologists.

Figure 7

ENVIRONMENTAL PROTECTION AGENCY
HEALTH EFFECTS RESEARCH LABORATORY
RESEARCH TRIANGLE PARK, NORTH CAROLINA


HERL - RTP
Director
SUPPORT SERVICES OFFICE
Deputy Director
PROGRAM OPERATIONS OFFICE
CRITERIA AND SPECIAL STUDIES OFFICE
STATISTICS AND DATA MANAGEMENT OFFICE
Data Management Staff
Statistics Staff
ENVIRONMENTAL TOXICOLOGY DIVISION
Toxic Effects Branch
Acute & Chronic Studies Section
Pathology & Microbiological Studies Section
Inhalation Toxicology Section
Biochemistry Branch
POPULATION STUDIES DIVISION
Special Pollutants Branch
Air Pollutants Branch
Exposure Assessment Branch
CLINICAL STUDIES DIVISION
Biomedical Research Branch
Clinical Pathology Branch
Physiology Branch
Research Services Branch
EXPERIMENTAL BIOLOGY DIVISION
Neurobiology Branch
Bioengineering Branch
Animal Care Branch
Developmental Biology Branch

U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF RESEARCH AND DEVELOPMENT

II. Environmental Sciences Research Laboratory

A. Introduction

The Environmental Sciences Research Laboratory at Research Triangle Park is a part of the Office of Air, Land, and Water Use in the Office of Research and Development. According to the laboratory's functional statement, it conducts an intramural and extramural research program in the physical sciences to detect, define, and quantify the effects of air pollution on urban, regional and global atmospheres and the subsequent impact on air quality, water quality and land use. The Environmental Sciences Research Laboratory (ESRL) carries out the following responsibilities:

1) Plans, implements and manages research and development programs designed to quantitate the relationships between emissions of pollutants from all types of sources and air quality and atmospheric effects;

2) Conducts laboratory and field investigations involving the sciences of chemistry, physics, and meteorology to obtain necessary information;

3) Integrates information from its program and the programs of other government agencies, private industry and the academic community to develop the technical basis for air pollution control strategies for the various pollutants;

4) Plans, implements, and manages a research and development program to provide needed techniques and instrumentation for the measurement and characterization of pollutants in the ambient air and in the emissions from all types of sources.

B. Workforce Profile

The Environmental Sciences Research Laboratory has a total permanent staff of 103 persons as of November, 1976. Most of the professional personnel employed by the Laboratory are chemists, physicists, meteorologists and chemical engineers. They are assigned to work in three divisions, which are:

> Emissions Measurements and Characterization Division: Responsible for the management and organization of an intramural and extramural research and development program on the application of the physical and engineering sciences to: a) identify and elucidate the chemical and physical nature of pollutants emitted to the atmosphere from all types of sources, both stationary and mobile; b) develop methods and instruments for precise and rapid identification and measurements of pollutants in mobile and stationary source emissions; and c) determine the impact of new industry, vehicle, fuel and emission control technology on the chemical and physical nature of pollutants emitted to the environment.
>
> Atmospheric Chemistry and Physics Division: Conducts an intramural and extramural research program to characterize the chemical composition and physical properties of the ambient air pollutants and to provide a quantitative understanding of relationships between the chemical composition and physical properties of emissions from mobile, stationary, and natural sources as related to air and water quality and land use.
>
> Meteorology and Assessment Division: Conducts intramural and extramural research in environmental meteorology to describe the roles and interrelationships of atmospheric processes and airborne pollutants in effective air, water and land resource management.

The Laboratory receives support from its Technical Planning and Review Office, its Laboratory Support Office and its Regional Air Pollution Study Coordination Office. The Environmental Sciences Research Laboratory has a ceiling for 1976 of 98 authorized permanent positions (they now have 103). In addition, 56 National Oceanic and Atmospheric Administration (NOAA) personnel have been assigned to the laboratory through an interagency agreement. Of the 56 positions assigned to ESRL, eight employees are located in the Office of Air Quality Planning and Standards, seven employees are located in regional offices of EPA and six employees are located in other laboratories of the Office of Research and Development. Of the remaining 35 positions located within ESRL nearly one-third have been assigned to the Atmospheric Modelling and Assessment Branch of the Meteorology and Assessment Division. Their activities are administered by the laboratory director and these personnel are paid from the budget of ESRL. Most of the NOAA personnel are meteorologists.

The laboratory also participates in the "stay-in-school" program, and 25 student aides were employed by the laboratory during 1976. An additional 37 temporary positions were filled in the laboratory as of November 1976.

The following table depicts current workforce for EPA permanent full-time employees at the laboratory.

TABLE XXII

RESEARCH TRIANGLE PARK

Environmental Sciences Research Laboratory
Current (1976) Staffing Level

Position	1976
Supervisor	13
Engineer	11
Chemist	37
Physicist	8
Physical Scientist	4
Technician	10
Other	20
TOTAL	103

C. Workforce Projections

Dr. Alfred H. Ellison, Deputy Director of the Environmental Sciences Research Laboratory, does not anticipate any growth in the number of permanent full-time personnel in this laboratory in the next five-year period. He anticipates that the laboratory's staffing level will decline slowly due to attempts to reach the authorized ceiling level of 98 permanent Civil Service positions. The principal reason for this attrition is the fact that the recent federal attitude has been to reduce the number of federal employees by having work performed through extramural or contractual agreements.

The increase for the Fiscal Year 1976 budget was 10 percent over that for Fiscal Year 1975. The proposal for Fiscal Year 1977 sent by the U.S. Environmental Protection Agency to the Office of Management and Budget called for significant increases in the EPA budget for Office of Research and Development research activities. Although budgets have increased, the laboratory's authorized ceiling level for personnel was reduced from 98 to 95 between Fiscal Years 1976 and 1977. No additional permanent personnel for the laboratory will be hired until the ceiling level is reached.

The Environmental Sciences Research Laboratory experiences little turnover. Most of the attrition takes place among the clerical rather than professional and technical employees, with an approximate annual average of 3 to 5 percent.

D. Training and Certification

Most of the staff professionals employed by ESRL do not participate in long-term course instruction activities, but several senior professionals have adjunct professorships at local universities in the Research Triangle Park area.

Almost all permanent employees of the laboratory receive some form of training each year. Their training needs are identified during annual performance rating sessions held for each employee. Such training usually consists of short courses. Professionals or those in higher position classifications participate in managerial or administrative enrichment programs that are approximately 40 hours duration. On occasion, professionals are also sent to the Federal Executive Institute at Oak Ridge, Tennessee, for management oriented training.

In addition, in-house training at the ESRL is carried out on-the-job. The Office of Administration at Research Triangle Park is in the process of implementing an "afternoon university" for all personnel in the form of various short courses. The Office of Administration will contract for instructors to come to Research Triangle Park from local colleges and universities to conduct courses introducing such subjects as languages, secretarial and other business skills, and academic subjects that are not technical in nature. The courses will range from the high school level to the college level and many will not be job-related.

A local chemical society chapter sponsors courses for their members in the Research Triangle Park area, and the EPA laboratories provide classrooms for this group's instructors to conduct classes. Research

Triangle Park also has a cooperative arrangement with the National Institute of Environmental Health Sciences to jointly conduct technical seminars pertaining to research topics of interest.

The Deputy Director of the Environmental Sciences Research Laboratory stated that there are few highly trained research scientists in the atmospheric sciences at the present time. Even if there were an increase in federal support for air pollution research, there would still be a lag in the effective use of such funds until the technical capabilities in the field were increased.

E. Career Potential

Laboratory professionals do not anticipate significant growth at ESRL in the next five years since they are currently above their authorized ceiling level. No new careers are expected to be developed to complement the laboratory staff in the next few years. Future needs may occur for socio-economists.

F. Conclusion

The Environmental Sciences Research Laboratory is not unique among the Office of Research and Development's laboratories in that low personnel ceiling levels have required that more work be performed by outside contractors. If additional responsibilities are acquired as a result of the Toxic Substances Control Act, with no allowances made for the authorized ceiling or budget, the additional work will be contracted. According to professionals in the field, the amount of work presently performed extramurally represents four times the amount of work performed in-house. The laboratory must also provide contract supervision over these external activities which diminishes the amount of work that can be performed by the permanent employees.

Figure 8

ENVIRONMENTAL PROTECTION AGENCY
Environmental Sciences Research Laboratory
Research Triangle Park, North Carolina

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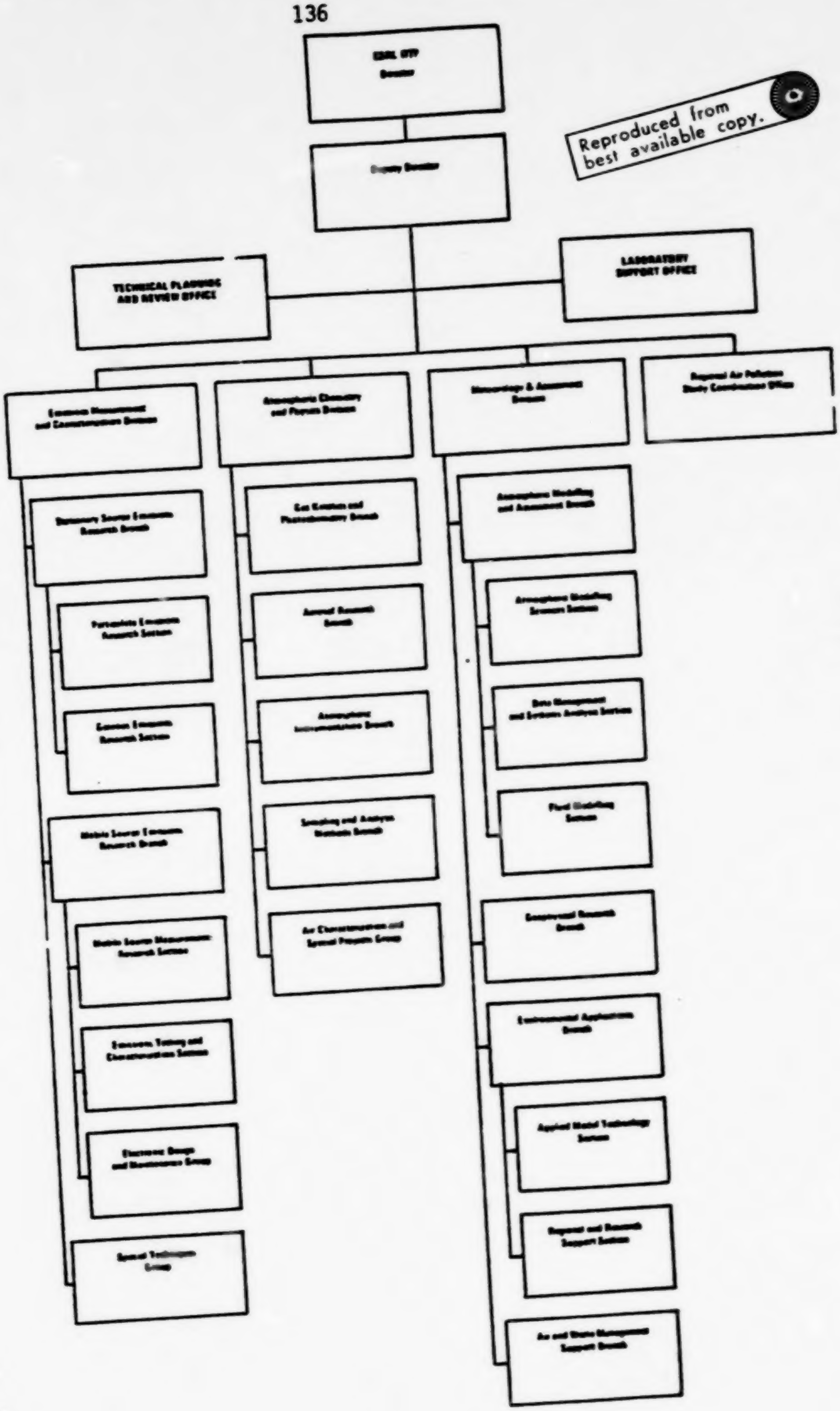

ESRL RTP
Director
Deputy Director
TECHNICAL PLANNING AND REVIEW OFFICE
LABORATORY SUPPORT OFFICE
Emissions Measurement and Characterization Division
Atmospheric Chemistry and Physics Division
Meteorology & Assessment Division
Regional Air Pollution Study Coordination Office
Stationary Source Emissions Research Branch
Particulate Emissions Research Section
Gaseous Emissions Research Section
Mobile Source Emissions Research Branch
Mobile Source Measurements Research Section
Emissions Testing and Characterization Section
Electronic Design and Maintenance Group
Special Techniques Group
Gas Kinetics and Photochemistry Branch
Aerosol Research Branch
Atmospheric Instrumentation Branch
Sampling and Analysis Methods Branch
Air Characterization and Special Projects Group
Atmospheric Modeling and Assessment Branch
Atmospheric Modeling Sciences Section
Data Management and Systems Analysis Section
Fluid Modeling Section
Geophysical Research Branch
Environmental Applications Branch
Applied Model Technology Section
Regional and Research Support Section
Air and Waste Management Support Branch

III. Industrial Environmental Research Laboratory

A. Introduction

The Industrial Environmental Research Laboratory (IERL) at Research Triangle Park is a part of the Office of Energy, Minerals and Industry in EPA's Office of Research and Development. Prior to the Office of Research and Development's reorganization in June of 1975, the Industrial Environmental Research Laboratory was assigned the tasks of developing technologies to control environmental pollution produced by stationary sources of air pollutants. Since the reorganization, laboratory efforts have been expanded to provide a multimedia approach to pollution control problems involving air, water, solid waste, thermal discharge, pesticides, and energy-conserving aspects of environmental pollution. The Industrial Environmental Research Laboratory receives legislative authority for its operations from the Air Quality Acts of 1967 and 1970, and the Federal Water Pollution Control Act and its amendments.

The laboratory's primary objective is to perform research and development on devices, processes, and systems to control pollution associated with industrial processes and with energy production. These tasks are accomplished through total environmental assessments, evaluation of pollution control alternatives and determinations of associated environmental impacts. Through its research, development, and demonstration of pollution control technologies, this laboratory is also placing increased emphasis on the development of sulfur oxides, nitrogen oxides, and particulate control technologies associated with the burning of coal.

B. Workforce Profile

The Industrial Environmental Research Laboratory's technical functions are accomplished through three divisions, with support provided by the Office of Program Operations. The divisions and their abbreviated functions are as follows:

> Utilities and Industrial Power Division: Conducts research and demonstration projects for the controlling of pollution resulting from fossil fuel combustion. Assesses the environmental, economic and energy aspects associated with the application of control technologies, and establishes methods for disposal or utilization of any by-products which may result. Addresses the problems of wastewater and sludge disposal from utility systems and other thermal pollutants.
>
> Energy Assessment and Control Division: Assesses, evaluates, and develops pollution control alternatives for energy-generating or utilization processes. Develops and demonstrates technology which is capable of minimizing pollution through the use of new combustion methods and advanced power systems.
>
> Industrial Processes Division: Assess, evaluates, develops and demonstrates environmental control techniques for various chemical processes including textiles, petrochemical, oil refining and agricultural chemical industries. In addition to the chemical effort, research and development activities associated with ferrous metallurgical industries are included in the division's programs. All are on a multimedia basis. Develops a sampling and analytical program to provide methods and instrumentation to accurately measure process streams, develops specialized measurement techniques for sulfates, toxic substances and fine particulates.

The laboratory is currently (November 1976) staffed with a total of 88 permanent full-time personnel. The following table depicts current workforce levels for permanent full-time employees at the laboratory as of October 31, 1976.

TABLE XXIII

RESEARCH TRIANGLE PARK

Industrial Environmental Research Laboratory
Current (1976) Staffing Level

Position	1976
Engineer	
Chemical	45
Civil	2
Mechanical	6
Environmental	1
Sanitary	2
General	1
Chemist	7
Engineering Aide/Technician	14
Technician	1
Other	9
TOTAL	88

Program analysts, writers, secretaries and other clerical personnel are included in the "Other" category in the above table. The laboratory also has personnel employed as trainees which include clerk-typists, clerk-translators, administrative technicians and physical science aides. Approximately 90 percent of the laboratory's work is being performed extramurally with each project officer supervising 20 to 30 contracted personnel.

Recruitment of laboratory personnel is carried out through U.S. Civil Service Commission procedures, but if the Commission is unable to supply qualified candidates for an opening, the Personnel Office is given recruitment authority.

C. Workforce Projections

Dr. Norbert Jaworski, Deputy Director of the Industrial Environmental Research Laboratory, indicated that the laboratory's first priority in workforce needs is for more project officers to manage and direct extramural contracts. An average project officer is responsible for overseeing six to eight projects worth over two and one-half million dollars. Over the next five-year period, the laboratory has a critical need for approximately twenty to forty additional professional personnel, primarily to serve as project officers. These additional personnel would increase the staffing level by 1982 to 130 or 140 permanent positions, for overseeing about 300 separate contracts. It is estimated that an increase of forty professionals would necessitate the acquisition of ten additional clerical positions to provide supportive services. Senior supervisory personnel of the laboratory estimate that they require, in addition to their present staff, ten sanitary engineers, fifteen environmental/chemical engineers, five industrial hygienists, three to four economists and three to four biostatisticians over the next five years.

The Industrial Environmental Research Laboratory has lost a total of 14 persons through attrition during the last two years. Sources indicate that losing seven persons through attrition is normal during a year's time. Ten to twelve of the fourteen persons were transferred to other laboratories of the Office of Research and Development during the reorganization of ORD in 1975.

D. Training and Certification

Most of the career professionals employed by the laboratory receive the bulk of their in-house training on the job. The principal method of obtaining outside technical training utilized by laboratory professionals is attendance at evening classes at local universities such as Duke University, North Carolina State University, and daytime classes at the University of North Carolina. Staff are also sent to the U.S. Civil Service courses for basic managerial or secretarial training. IERL management is making a concerted effort to have all of its supervisory personnel obtain the required supervisory training. About 80 percent of the supervisory staff has had the minimal training, others have more; however, reduced travel funds is constraining this training effort.

The professionals currently employed by the Industrial Environmental Research Laboratory are well-trained in the field of air pollution control and abatement. In order to cross-train them in other areas to develop multimedia skills such as in water pollution control, IERL conducted a nine-week course given by a local university at the Environmental Research Center.

E. Career Potential

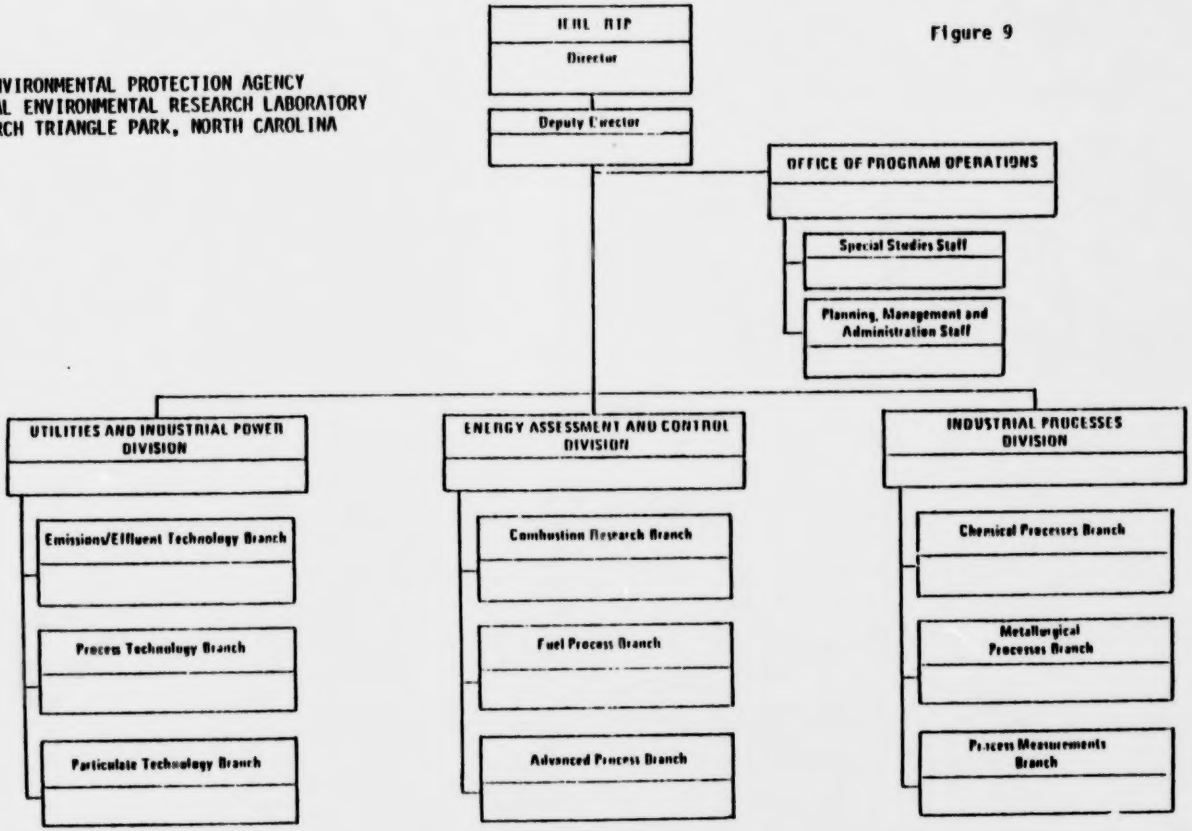
Although the Industrial Environmental Reserach Laboratory is not expected to increase its staffing level dramatically over the next five years, laboratory professionals have identified needs not only for more chemical engineers but for industrial hygienists, biostatisticians, economists and environmental and sanitary engineers. Of these, only environmental sanitary engineers are currently represented in the present staffing profile. Laboratory officials were unable to state with any confidence whether or not the needed positions were likely to be obtained over the next five year period.

F. Conclusion

The Industrial Environmental Research Laboratory at Research Triangle Park is currently operating with a professional staff that spends a large protion of its time managing contractual projects. As the laboratory has recently expanded the amount of extramural funds and its scope of activities to include water pollution control and solid waste management, the staff needs additional training in these areas to upgrade expertise to an equivalent level with that currently available in the field of air pollution control and abatement. On-the-job training and symposia constitute the primary means by which such additional training needs are acquired. Any additional professional personnel acquired in the next five years would probably be designated to serve as project officers over the laboratory's contractual work.

Figure 9

ENVIRONMENTAL PROTECTION AGENCY
INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY
RESEARCH TRIANGLE PARK, NORTH CAROLINA


IERL RTP
Director
Deputy Director
OFFICE OF PROGRAM OPERATIONS
Special Studies Staff
Planning, Management and Administration Staff
UTILITIES AND INDUSTRIAL POWER DIVISION
Emissions/Effluent Technology Branch
Process Technology Branch
Particulate Technology Branch
ENERGY ASSESSMENT AND CONTROL DIVISION
Combustion Research Branch
Fuel Process Branch
Advanced Process Branch
INDUSTRIAL PROCESSES DIVISION
Chemical Processes Branch
Metallurgical Processes Branch
Process Measurements Branch

U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF RESEARCH AND DEVELOPMENT

IV. Environmental Monitoring and Support Laboratory

A. Introduction

The Environmental Monitoring and Support Laboratory (EMSL) at Research Triangle Park is under the Office of Monitoring and Technical Support within the Office of Research and Development. This laboratory's technical staff provides specialized monitoring and analytical support for the Environmental Protection Agency's programs. Technical staff are responsible for the operation of an agency-wide Air Pollution Quality Assurance Program and for the Fuels and Additive Registration Program. Analytical methods, standardization evaluations and monitoring methods are developed for the sampling and analysis of ambient, source and hazardous air pollutants. The laboratory is also responsible for the determination of reference and equivalent methods for monitoring ambient air as it relates to the National Ambient Air Quality Standards.

According to the laboratory's functional statement, most of the programs conducted by the Environmental Monitoring and Support Laboratory are in response to the following applicable regulations:

1) National Primary and Secondary Ambient Air Quality Standards;

2) Requirements for Preparation, Adoption and Submittal of Implementation Plans;

3) Standards for Performance for New Stationary Sources;

4) National Emission Standards for Hazardous Pollutants;

5) Ambient Air Monitoring Reference and Equivalent Methods;

6) Pb and P Gasoline Regulations;

7) Mobile Source Emission Regulations;

8) Toxic Substances Law;

9) Fuel and Fuel Additive Registration Regulations.

B. Workforce Profile

The Environmental Monitoring and Support Laboratory's technical tasks are performed by four branches. In addition, a regional office liaison staff is administered by the laboratory. The four branches and their abbreviated functions are as follows:

> Analytical Chemistry Branch: Provides analytical capabilities to the Office of Research and Development at Research Triangle Park for the measurement of trace elements and other pollutants. Provides analytical technical support and specialized training to EPA Regional, state and local laboratories. Develops new methods, modifies existing methods, and provides analytical services in support of ongoing studies, including research monitoring. Maintains liaison and provides technical assistance to the Office of Air Quality Planning and Standards and analytical laboratory services in support of EPA programs for trend monitoring for State Implementation Plans, enforcement actions and other related items.
>
> Statistical and Technical Analysis Branch: Provides statistical, mathematical and computer services to the laboratory's technical staff. Participates in the mathematical and statistical design, execution and data analysis of quality assurance, methods standardization, analytical and field monitoring, and other projects. Responsible for the regulation of all fuels and fuel additives under the provisions of the Clean Air Act.

Quality Assurance Branch: Responsible for the conduct and implementation of an EPA air pollution quality assurance program. Develops and conducts a methods standardization program involving laboratory and field evaluation, procedure revision, and testing of methodology resulting in publication of standard measurement methods for ambient air, and stationary sources. Prepares Quality Assurance guideline documents with assistance from the Statistical and Technical Analysis Branch.

Environmental Monitoring Branch: Installs, calibrates, operates and maintains special multi-purpose monitoring stations and networks. Provides guidance to other governmental agencies in the design and operation of monitoring support. Determines the equivalency of methods and instruments to published ambient air reference methods. Evaluates commercially available air pollution environmental monitoring instrumentation.

The Environmental Monitoring and Support Laboratory operates with a total staff of 104 positions, 90 of which are permanent, as of October 1976. The current (1976) ceiling established for the laboratory is 90 permanent Civil Service positions. Fourteen positions are filled on a temporary basis as of that date. These positions include clerical and administrative employees and physical science aides. One meteorologist of the National Oceanic and Atmospheric Administration has also been assigned to the laboratory through an interagency agreement. The number of temporary employees varies between ten and twenty, laboratory officials estimate.

The following table depicts the current (1976) workforce level for full-time permanent EPA personnel employed by the Environmental Monitoring and Support Laboratory.

TABLE XXIV

RESEARCH TRIANGLE PARK

Environmental Monitoring and Support Laboratory
Current (1976) Staffing Level

Position	1976
Physical Science Administrator	4
Engineer[1]	9
Chemist	37
Statistician/Mathematician/ Computer Programmer	6
Technician[2]	21
Specialized Fields[3]	3
Other[4]	10
TOTAL	90

[1] Includes chemical, public health and quality assurance engineers.

[2] Includes two statistical clerks, sixteen physical science aides and technicians, and three electronics technicians.

[3] Includes an environmental protection assistant, a quality assurance specialist and an operations research analyst.

[4] Includes clerical support and administrative personnel.

C. Workforce Projections

The laboratory has experienced a substantial decline in its staffing level since 1972-1973. Officials still consider the laboratory workforce level to be in a declining mode, although these officials consider the laboratory to be currently understaffed. Assuming that no further reorganization takes place, and that the EMSL's missions and responsibilities are not substantially altered, officials project that additional chemists and engineers that specialize in environmental pollution control will be required, as well as statisticians. A significant portion of the laboratory's activities will of necessity be contracted due to a current and projected future shortage of in-house personnel. However, EMSL officials have emphasized that contractors with the required expertise and areas of specialization required are not readily available, and most current contractors are overburdened with responsibilities and lack the required number of qualified personnel.

D. Training and Certification

Few, if any, laboratory personnel are able to attend long-term training at colleges and universities. A number of persons are able to participate in courses each year for college credit. Each person employed by the laboratory is encouraged to attend one course per year, although travel budget restrictions significantly limit the training that is offered outside the Research Triangle Park vicinity. Clerical staff attend courses offered in the local area by the U.S. Civil Service Commission, and all supervisors have taken 80 hours of management training and are encouraged to participate in update training. Because of travel constraints officials, to an extent, rely upon informal on-the-job taining to acclimate new employees.

At least once each year, employees discuss with their supervisors their training desires and needs. Emphasized by officials are those courses that teach safety, those that aid in the performance of job duties such as technical writing, speed reading and statistics, and those that provide instruction in new advanced analytical techniques. Employee training plans, which could include attendance of technical courses offered by colleges and universities or those offered by the Civil Service Commission, or the attendance of professional conferences, seminars and meetings throughout the country, are subject to limitations imposed by travel restrictions.

E. Career Potential

Although laboratory officials could not identify new careers which might arise in their field over the next five years, passage of the Toxic Substances Control Act (TOSCA) would impact the laboratory's growth rate if ceiling levels are relaxed. Passage of the Act could mean an annual 4 to 5 percent increase in engineers and chemists if EPA headquarters accepts the non-criteria monitoring strategy for TOSCA that the laboratory is developing. Officials have emphasized that qualified engineers and chemists with expertise in the areas of environmental monitoring and quality control will continually be in demand by the laboratory, although these persons are not readily available.

F. Conclusion

Although the Environmental Monitoring and Support Laboratory may acquire additional responsibilities as a result of the passage of TOSCA, hiring freezes and other constraints such as travel restrictions have reduced the effectiveness of the work that can be accomplished. If personnel ceiling levels are relaxed, additional qualified engineers, chemists and statisticians may be recruited . A major portion of the EMSL's duties will continue to be contracted, although contractors are also faced with work overloads and a shortage of qualified personnel with expertise in the required areas of specialization.

In sum, the laboratory faces a problem with several facets. An employee ceiling has caused the laboratory to be understaffed, professionals are not readily available with the required expertise, and travel restrictions prevent employees from attending the training required for performing to their fullest capacities.

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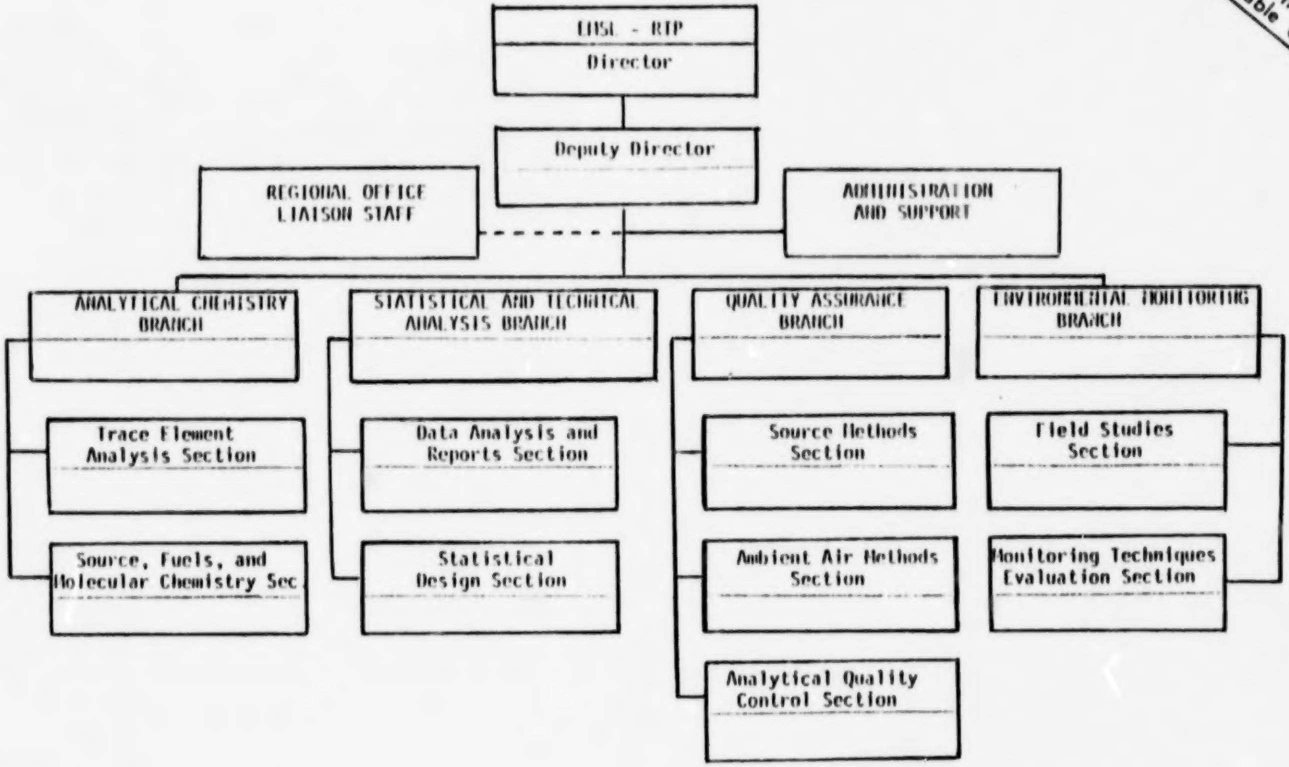
ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY
RESEARCH TRIANGLE PARK, NORTH CAROLINA

Figure 10


EMSL - RTP
Director
Deputy Director
REGIONAL OFFICE LIAISON STAFF
ADMINISTRATION AND SUPPORT
ANALYTICAL CHEMISTRY BRANCH
Trace Element Analysis Section
Source, Fuels, and Molecular Chemistry Sec
STATISTICAL AND TECHNICAL ANALYSIS BRANCH
Data Analysis and Reports Section
Statistical Design Section
QUALITY ASSURANCE BRANCH
Source Methods Section
Ambient Air Methods Section
Analytical Quality Control Section
ENVIRONMENTAL MONITORING BRANCH
Field Studies Section
Monitoring Techniques Evaluation Section

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA

The Office of Air Quality Planning and Standards (OAQPS) is responsible for developing national standards for air quality, emission standards for new stationary sources, and emission standards for hazardous pollutants. National programs, technical policies, regulations, guidelines, and criteria for air pollution control are developed by OAQPS, and assessments of the national air pollution control program and the success in achieving air quality goals are carried out.

Assistance is provided by the laboratory to states, industry and other organizations through training activities and technical information, and technical direction and support is provided to EPA regional offices. Regional programs are also evaluated by the laboratory with respect to state implementation plans and strategies, technical assistance, and resource requirements and allocations for programs related to air pollution control. The laboratory also develops and maintains a national air programs data system and provides technology transfer through the translation of technological developments into improved controlled program procedures.

The OAQPS is under the supervision of the Deputy Assistant Administrator for Air Quality Planning and Standards. This Deputy Assistant Administrator is responsible to the Assistant Administrator for the air quality planning and standards functions of the Office of the Assistant Administrator for Air and Waste Management.

B. Workforce Profile

To carry out its mission, the OAQPS maintains four major programs: air pollution control, emission standards for stationary sources, monitoring and data analysis, and pollution strategies. Organizationally, the laboratory maintains four divisions. The following lists the names and functions of these divisions, as adapted from the OAQPS document, "Office of Air Quality Planning and Standards Organizational Charts and Functional Statements", December 1976.

> Emission Standards and Engineering Division: Responsible for developing national emission standards for hazardous pollutants, developing national performance standards for new sources, and conducting emission tests in support of standard development and evaluating standard test methods. Conducts surveys and studies of stationary source categories to determine the nature and magnitude of air pollution emissions, control methods and procedures, and economic data. Provides technical assistance and documentation regarding emission control technology, reviews technological developments for translation into improved control procedures, and reviews standard development alternatives for compatibility with technology and regulatory authority.
>
> Monitoring and Data Analysis Division: Responsible for providing detailed analysis and evaluation of air quality, source emissions and related engineering data. Analyzes abatement and control strategies and develops methodology for the determination of significant trends leading to the attainment or non-attainment of air quality standards and preparing reports pertaining to national, state and regional trends. Develops, operates and maintains a national data bank for the collection and distribution of air quality and emission data. Evaluates air pollution control strategies through the use of simulation models. Reviews environmental impact statements. Monitors meteorological and air quality parameters on a nationwide basis to determine the existence or potential of air pollution episodes.

> Control Programs Development Division: Responsible for developing policy and providing national overview for air pollution control programs under Section 110 and 111(d) of the Clean Air Act. Analyzes policy alternatives and develops program guidance for effective governmental air pollution control programs. Collects information and monitors progress under Section 110, and evaluates EPA's air pollution control strategies with the EPA regional offices. Identifies field level needs for policy and technical guidance and coordinates their development with other headquarters elements. Manages the training and technical information services.
>
> Strategies and Air Standards Division: Responsible for pollutant identification, control strategy analysis and the development of ambient air quality standards. Responsibilities include formulating, recommending, and implementing policies and actions to meet energy demands compatible with desirable environmental policies; developing and maintaining projections of the effect of current and anticipated pollutant control strategies; analyzing alternative standards and strategies for the control of pollutants; recommending new or revised air air quality standards; performing studies and economic analyses to assess the cost of pollutant strategies and control techniques; land use planning in relation to air quality; studying the environmental impact of changes in land use, and recommending guidelines for incorporating air quality standards into their planning. Provides guidance and technical support to the regional offices.

The laboratory also maintains an Office of Regional Programs. This office plans, coordinates and reviews a comprehensive program to provide intercommunication and assistance between EPA's regional offices and OAQPS on all matters of mutual interest and/or responsibility.

The Office of Air Quality Planning and Standards currently employs 289 full-time permanent EPA employees. In addition, 25 temporary personnel are currently employed by OAQPS, including secretaries and professional consultants; this number varies from year to year. Consultants are also assigned to the laboratory through federal interagency agreements, a number of whom also varies greatly from year to year.

The following table depicts the current (1976) workforce level for permanent full-time EPA employees within OAQPS

TABLE XXV

RESEARCH TRIANGLE PARK

Office of Air Quality Planning and Standards
Current (1976) Staffing Level

Position	1976
Engineer	
Civil	4
Sanitary	12
Environmental	70
Chemical	32
Mechanical	7
General	9
Sanitarian	1
Scientist[1]	63
Technician[2]	6
Other[3]	85
TOTAL	289

[1] This category includes physical scientists, physical science administrators, economists, environmental protection specialists, environmentalists.

[2] This category includes electronic technicians, engineering aides.

[3] This category includes administrative personnel, clerks, ADP and other supportive personnel.

The laboratory also utilizes contractors to perform stack testing at industrial plants across the nation. The actual testing is conducted at well-controlled plants and the data is used to develop new source emission standards and to assess the environmental impact of control technology currently in use.

C. Workforce Projections

Laboratory officials have indicated that the OAQPS staffing level has been relatively stable over the last two years and minimal staffing level changes are expected over the next five years. A maximum of five to ten additional positions may be acquired over this time frame. Sources indicate that due to the recent creation of Civil Service Commission classification of Environmental Protection Specialists, Environmental Assistants and Environmental Engineers, it is anticipated that the positions acquired during the next five years would likely be of these series.

The average annual turnover rate for laboratory personnel is estimated to be 5 to 6 percent. This translates into 20 to 25 vacancies per year.

D. Training and Certification

Most of the in-house training for new personnel within OAQPS is carried out informally, whereby new entrants work closely with experienced personnel for varying periods of time. Laboratory officials have expressed a need for the development of a formal and standardized orientation/training process for new entrants, especially for those of the higher professional positions.

The federal government sponsors a program to provide long-term training to federal employees. Candidate selection is carried out through a nomination procedure in which such factors as justification, need and candidate competition play a role. This process is highly selective, and OAQPS officials estimate that one or two professionals from this laboratory have participated in this program during the last two to three years.

Personnel are sent to one-week taining courses conducted by the U.S. Civil Service Commission or by universities in the Research Triangle Park area. Courses conducted by the American Management Association are occasionally attended by OAQPS personnel as are short courses offered by the Office of Administration at Research Triangle Park. Most of these courses concern human relations or management and are oriented toward upgrading the skills of the supervisory personnel. Short courses offered by universities are often of a more technical nature.

The office attempts to outline for new employees the levels of education required to advance in their series classifications. Every year, in a semi-formal manner, each employee participates in a performance with his/her supervisor. In the course of these evaluations, supervisors discuss with their subordinates what additional training is considered necessary to perform their jobs. Each employee is provided the opportunity to identify what job-related training he or she would like to receive.

The Manpower and Technical Information Branch (MTIB) of the Control Programs Development Division of OAQPS is responsible for the management of training and technical information services for EPA and state and local air pollution control programs. The activities of this branch can be divided into three main categories: direct training, adademic/university programs and technical information.

MTIB has contracted with Northrop Services, Inc. since July 1, 1976 to offer direct training to persons in the public and private sectors working in the field of air pollution control. This group has been assigned the following tasks:

Task I: Prepare and present the thirty listed courses at Research Triangle Park, North Carolina, and in the field for the equivalent of approximately fifty-four weeks of training per year.

Task II: Provide special seminars to the university-based regional training centers; provide support services; develop, produce, and supply training resource materials for all APTI activities including Task I courses and the courses presented in the field.

Task III: Provide technical assistance and supply, on a limited basis, course manuals and other printed training materials, and selected audio-visual software to federal, state and local air pollution control training programs.

Task IV: Provide services necessary to effectively prepare and present special seminars and workshops in new and emerging areas such as significant deterioration, quality assurance, and inspection/maintenance.

Task V: Revise and/or prepare course materials for approximately five course per year and update all other remaining APTI course offerings; develop approximately thirty-five hours of air pollution self-instructional material; and design, develop, and validate three new training courses.

The number of persons taking advantage of courses offered by the MTIB has been declining in the past two years chiefly due to the policy implemented in 1975 of charging tuition for the courses. Officials predict that the number of trainees will increase after the passage of amendments to the Clean Air Act which will abolish the tuition charges.

MTIB officials have provided estimates of training needs in air pollution control for the public sector and for auto mechanics, and have provided estimates of the training provided to assist in meeting these needs during Fiscal Year 1976. These estimates are depicted in the following tables. Note that private industry has not been included as the workforce and needs were considered extremely difficult to estimate.

TABLE XXVI

RESEARCH TRIANGLE PARK

Training Needs for Air Pollution Control
(estimated by MTIB)

Sector	Technical and Professional Staff	Training Weeks Per Year
EPA	2,600	4,500
State/Local	5,400	14,500
Other Federal	3,900	6,100
Auto Mechanics	250,000	250,000
TOTAL	261,900	275,100

TABLE XXVII

RESEARCH TRIANGLE PARK

Training Conducted During FY '76 to Meet Air Pollution Control Needs
(estimated by MTIB)

Sector	1976
By EPA:	
For EPA	460
For State/Local	710
For Other Federal	60
By State/Local (for own staff)	2,500
By Other Federal	2,600
By Universities with EPA Grants:	
EPA Trainees	1,600
Other Students	1,150
EPA Fellowships	1,600
Environmental Management Institute	720
Other University (no EPA grant)	3,600
EPA Fostered Mechanics Training	10,000
TOTAL	25,000

It is evident through comparisons of the above tables that MTIB believes that the current level of training available in the field of air pollution control is not adequate to meet the needs. During Fiscal Year 1977, MTIB and its contractor are expanding the course offerings, are offering workshops, and are producing self-instructional packaged courses and instruction resource materials for public agencies involved in air pollution control. In addition, MTIB is contracting with a number of universities to provide for the presentation of short-term training courses in order to be able to present a higher percentage of its courses at field locations. The institutions will teach the same courses as MTIB and its contractor and will use the same course materials furnished and used by MTIB. The universities involved are the following:

1) New England Consortium on Environmental Protection
   Weston, Massachusetts,

2) University of Texas
   Austin, Texas,

3) University of Cincinnati
   Cincinnati, Ohio,

4) University of Southern California
   Los Angeles, California,

5) The Cooper Union
   New York City, New York,

6) Rensselaer Polytechnic Institute
   Troy, New York,

7) University of Washington
   Seattle, Washington.

In Fiscal Year 1978 the MTIB plans to present 20 different courses for a total of 78 course presentations, as follows:

	Course Location	
	RTP	Field
Northrop Services, Inc.	23	25
Area Training Centers	0	30
Sub Total	23	55
TOTAL	78	

In an effort to enhance state/local agency capability to conduct training for their own personnel and overcome travel constraints, MTIB will step up production and distribution of self-instructional packaged courses and instructional resource materials. Plans are also underway to step up the number of workshops and improve the methods of delivery of workshops on new emerging topics so that more information can be presented to regional, state and local personnel.

The academic/university programs that the MTIB participates in include training grants, fellowships and specialty programs. During Fiscal Year 1976 the branch supported nine university programs under training grants for a total of 72 trainees supported. This number is expected to remain relatively stable through Fiscal Year 1977. Under the Fellowship Program, 55 full-time and 80 part-time fellows were supported during Fiscal Year 1976; an estimated 33 full-time and 85 part-time fellows are being supported during Fiscal Year 1977. Approximately 62 percent of fellows supported work with government agencies after leaving the program. Special projects of the MTIB include the New England Consortium on Environmental Protection, the Environmental

Management Institute at the University of Southern California and the mechanics training program at Colorado State University.

Through its technical information activities, the MTIB ensures that EPA, state and local air pollution agencies, as well as the private sector, are provided with adequate technical information. Under terms of a contract with Franklin Institute, the files of the Air Pollution Technical Information Center are publicly accessible on the on-line computer system of the Lockheed Corporation. In addition to monitoring and overseeing this contract, the MTIB carries out such activities as literature searches, publication dissemination, and workshop conduction for literature system users.

E. Career Potential

The OAQPS experiences the most difficulty in recruiting women and other minorities for entry level positions. Qualified minorities often can demand higher salaries in the private sector and for this reason it is difficult for the Office to satisfy equal employment opportunity guidelines. Qualified minorities will thus receive extra consideration for future positions in the next five year period, according to OAQPS officials.

No new careers are foreseen by OAQPS officials to be emerging in the next five years. Only five to ten additional positions (environmental protection assistants and engineers) are expected to be acquired by 1982. Increasing emphasis is likely to be placed upon technical writing skills in the hiring process.

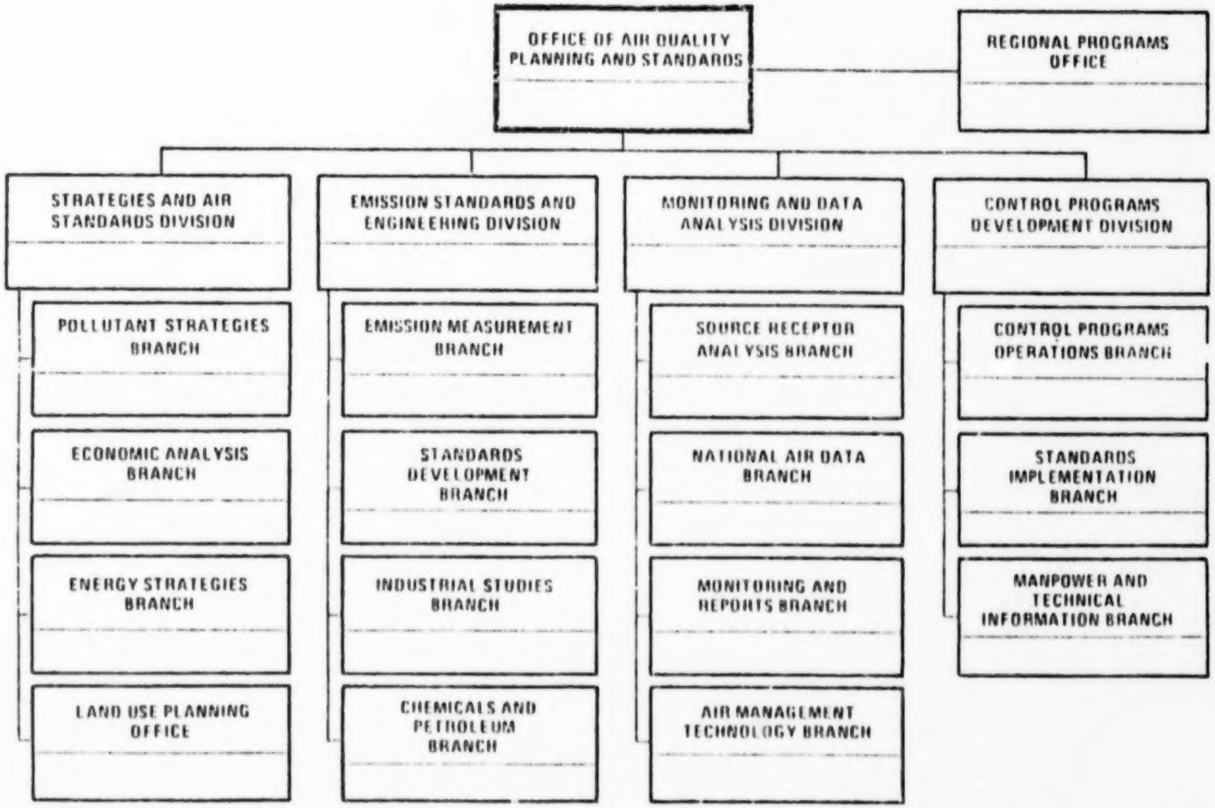
F. Conclusion

The Office of Air Quality Planning and Standards's staffing level has stabilized over the last two years. Sources in the field indicate the present staff is considered adequate to perform the basic mission, and that minimal staffing increases are likely to occur in the next five years. It is likely that activities that cannot be performed by the present staff will be contracted to be performed by outside contractors. If priorities shift within the office and certain functions receive more emphasis than others, further reorganizations may be necessary. Staff training within OAQPS is mostly informal on-the-job training with new personnel placed with more experienced professionals until they have demonstrated an ability to perform their duties alone. For upgrade purposes, personnel may attend courses offered by the U.S. Civil Service Commission, the American Management Association, the RTP Office of Administration or local colleges/universities. Few personnel are able to participate in federally supported post-graduate training programs.

The OAQPS, through it Manpower and Technical Information Branch, is responsible for the management of training and technical information services for EPA and state and local air pollution control programs. Specific activities include direct training, the coordination of training grants, fellowship programs and speciality programs, and technical information dissemination.

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards

Figure 11


OFFICE OF AIR QUALITY PLANNING AND STANDARDS
REGIONAL PROGRAMS OFFICE
STRATEGIES AND AIR STANDARDS DIVISION
POLLUTANT STRATEGIES BRANCH
ECONOMIC ANALYSIS BRANCH
ENERGY STRATEGIES BRANCH
LAND USE PLANNING OFFICE
EMISSION STANDARDS AND ENGINEERING DIVISION
EMISSION MEASUREMENT BRANCH
STANDARDS DEVELOPMENT BRANCH
INDUSTRIAL STUDIES BRANCH
CHEMICALS AND PETROLEUM BRANCH
MONITORING AND DATA ANALYSIS DIVISION
SOURCE RECEPTOR ANALYSIS BRANCH
NATIONAL AIR DATA BRANCH
MONITORING AND REPORTS BRANCH
AIR MANAGEMENT TECHNOLOGY BRANCH
CONTROL PROGRAMS DEVELOPMENT DIVISION
CONTROL PROGRAMS OPERATIONS BRANCH
STANDARDS IMPLEMENTATION BRANCH
MANPOWER AND TECHNICAL INFORMATION BRANCH

Selected Post Secondary Institutions With Formal Environmental Energy Programs

On the following pages are detailed descriptions of environmental curricula available at two educational institutions in North Carolina: The University of North Carolina at Chapel Hill and Wilson County Technical Institute in Wilson. The University offers several M.S. and Ph.D. programs designed to produce graduates prepared for environmentally related employment. They include: 1) Air and Industrial Hygiene, 2) Environmental Chemistry and Biology, 3) Environmental Management and Protection, 4) Radiological Hygiene, and 5) Water Resources Engineering. Students at Wilson County Technical Institute may earn an A.S. degree in Sanitary Landfill Technology.

Elsewhere in the state there are institutions offering similar or environmentally related curricula. For example, North Carolina State University in Raleigh provides graduate students with an optional minor in Air Conservation or Water Resources. Undergraduate Civil Engineering majors may continue their environmental coursework and research on M.S. or Ph.D. levels. The Department of Nuclear Engineering offers M.S. and Ph.D. programs that provide study geared to careers in related energy and environmental fields.

Students at the University of North Carolina at Charlotte may earn a B.S. degree in engineering which is intended to qualify graduates to become professional civil engineers. Minor options within the degree program include Environmental and Water Resources Engineering. Students may also select the Bachelor of Engineering Technology Degree program which contains environmentally related coursework but is distinct from professional engineering curricula.

The University of North Carolina at Wilmington offers a B.A. degree with a concentration in Environmental Studies. Students may specialize within the concentration by selecting from four options.

Pfeiffer College in Misenheimer offers a bachelor level degree in Environmental Studies. This degree is an inter-departmental program, therefore, students receive coursework from the Sciences, Social Sciences, and Humanities.

Environmental Science Technology is one of two optional specializations within the Food and Environmental Science Technology program at Wilkes Community College in Wilkesboro. This program is designed as a two-year study.

St. Andrews Presbyterian College in Laurinburg offers a major in Environmental Studies in which students may develop individual contracts in consultation with the program coordinator and participating faculty.

A.B. or B.S. degrees in environmental studies are available to students at Lenoir-Rhyne College in Hickory. Within the program there are five areas of emphasis: Biology, Chemistry, Earth Science, Physics, and Social Science.

Martin Community College in Williamston awards an Associate in Applied Science Degree to students who complete the Environmental Science Technology curriculum. The program is designed to produce trained technicians to deal with problems of air, water, and chemical pollution.

Fayetteville Technical Institute in Fayetteville provides two environmental programs, Environmental Engineering Technology and Water and

Wastewater Plant Operators Curricula. The former curriculum, which upon completion merits an Associate in Applied Science degree, is geared to producing graduates capable of work in areas related to Environmental Engineering and Public Health. The latter program through the Vocational Education Division is intended to train students to analyze, operate, and control water purification and wastewater treatment facilities.

Western Piedmont Community College in Morganton provides a special certificate program to train Wastewater Treatment Operators. The curriculum is designed as a two-year study program.

Duke University offers two graduate level programs designed to provide training in environmental studies. Students in the School of Forestry and Environmental Studies may earn a Master of Environmental Management, while those in the department of Civil Engineering may qualify for an M.S. degree with an emphasis in Urban and Environmental Engineering.

Eastern Carolina University in Greenville offers an Environmental Health Curriculum at the undergraduate level. Shaw University in Raleigh offers an Environmental Science curriculum. Pitt Technical Institute in Greenville offers an associate degree in Air and Water Resources Technology. Durham College offers a curriculum in Environmental Health Sciences.

The information presented in this introduction was derived from college literature and interviews with faculty.

SENIOR INSTITUTIONS

University of North Carolina at Chapel Hill
Chapel Hill, North Carolina

Program: Air and Industrial Hygiene (M.S.P.H., M.S.E.E., Ph.D.)

Hours required for major: Semester (M.S.P.H., M.S.E.E.) 30*; (Ph.D.) 19* exclusive of the disseration
Program Inception: 1960
Staff Size: Twelve professors, eight associate professors, eight assistant professors, six graduate assistants (25 Ph.D.s, 3 M.S.E.E.)
Enrollment: (M.S.P.H.) 17, (M.S.E.E.) 7, (Ph.D.) 9
Graduates (1976): (M.S.P.H.) 8, (M.S.E.E.), 5, (Ph.D.) 2
Placement: 15
Graduate Work: 0

Program: Environmental Chemistry and Biology (M.S.P.H., M.S., Ph.D.)

Hours required for major: Semester (M.S.P.H., M.S.) 30*; (Ph.D.) 19* exclusive of the disseration
Program Inception: 1960
Staff Size: Twelve professors, eight associate professors, eight assistant professors, six graduate assistants (25 Ph.D.s, 3 M.S.E.E.)
Enrollment: (M.S.P.H.) 19, (M.S.) 2, (Ph.D.) 13
Graduates (1976): (M.S.P.H.) 5, (M.S.) 1
Placement: 6
Graduate Work: 0

Program: Environmental Management and Protection (M.S.P.H., M.S.E.E., Ph.D.)

Hours required for major: Semester (M.S.P.H., M.S.E.E.) 30*; (Ph.D.) 19* exclusive of the dissertation

Program Inception: 1960
Staff Size: Twelve professors, eight associate professors, eight assistant professors, six graduate assistants (25 Ph.D.s, 3 M.S.E.E.)
Enrollement: (M.S.P.H.) 21, (ph.D.) 2
Graduates: (M.S.P.H.) 9
Placement: 9
Graduate Work: 0

Program: Radiological Hygiene (M.S.P.H., M.S., Ph.D.)

Hours required for major: Semester (M.S.P.H., M.S.) 30*; (Ph.D.) 19* exclusive of the disseration
Program Inception: 1960
Staff Size: Twelve professors, eight associate professors, eight assistant professors, six graduate assistants (25 Ph.D.s, 3 M.S.E.E.).

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* With appropriate qualifying degrees.

Enrollment: (M.S.P.H.) 5, (M.S.) 1, (Ph.D.) 1
Graduates (1976): (M.S.P.H.) 2
Placement: 2
Graduate Work: 0

Program: Water Resources Engineering (M.S.E.E., Ph.D.)

Hours required for major: Semester (M.S.P.H.) 30* (Ph.D.) 19*exclusive of the dissertation.
Program Inception: 1960
Staff Size: Twelve professors, eight associate professors, eight assistant professors, six graduate assistants (25 Ph.D.s, 3 M.S.E.E.)
Enrollment: (M.S.E.E.) 19, (Ph.D.) 3
Graduates (1976): (M.S.E.E.) 8, (Ph.D.) 1
Placement: 9
Graduate Work: 1

Courses

Environmental Protection
Reading in Environmental Sciences and Engineering
Elements of Environmental Health
Man and His Environment
Applied Electron Microscopy
Quantitative Studies for Environmental Sciences
Readings in Environmental Chemistry and Biology
Water Chemistry
Organic Materials in Natural Waters
Environmental Kinetics of Chemistry and Biology
Oceanography
Chemical Oceanography
Chemical Oceanography Lab
Biology in Environmental Science
Limnology and Water Pollution
Environmental Biology
Environmental Microbiology
Ecology
Ecology Laboratory
Biological Oceanography
Ecology of Wetlands
Environmental Virology
Readings in Air and Industrial Hygiene
Elements of Air Hygiene
Elements of Industrial Hygiene

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* With appropriate qualifying degrees.

Applied Physiology and Toxicology
Air Pollution, Measuring, Monitoring and Survey
Instrumentation and Data Aquisition
Industrial Hygiene Engineering Control Design
Industrial Ventilation Laboratory
Occupational Safety
Reading in Environmental Management and Protection
Microbiology of the Institutional Environment
Management of the Institutional Environment
Reading in Radiological Hygiene
Elements of Radiological Hygiene
Modern Physics for Environmental Science
Radiation Instrumentation
Field Observations in Radiological Hygiene
Reading in Sanitary Engineering and Water Resources
Principles of Water Quality Management
Workshop in Water Quality Management
Water and Wastes Treatment Processes
Water and Wastes Treatment Processed Laboratory
Hydraulics and Hydrology
Special Topics in Water Resources
Problems in Environmental Sciences and Engineering
Environmental Management
Environmental Protection: Planning and Development
Environmental Issues and Assessment
Systems Analysis in Environmental Planning
Environmental Systems Analysis I: Deterministic Models
Environmental Systems Analysis II: Probabilistic Models
Problems in Environmental Chemistry and Biology
Instrumental Methods of Analysis
Special Topics in Aquatic Chemistry
Trace Analysis
Ecological and General Systems Theory
Limnological Methods
Special Topics in Aquatic Biology
Microbial Ecology
Ecology of Phytoplankton
Problems in Air and Industrial Hygiene
Introduction to Aerosol Science
Aerosol Science Laboratory
Industrial Hygiene Practice
Air and Its Contaminants
Industrial Hygiene Laboratory
Air Pollution Control
Biological Effects of Air Pollution
Chemistry of the Troposphere
Industrial Medicine-Practice and Management

Air Pollution Meteorology
Problems in Environmental Management and Protection
Environmental Protection I
Environmental Protection II
Environmental Protection III
Solid Wastes Management
Problems in Ragiological Hygiene
Radiation Biophysics
Health Physics
Radiation Hazards Evaluation I
Radiation Hazards Evaluation II
Problems in Sanitary Engineering and Water Resources
Modeling in Natural Aquatic Systems
Technology of Engineered Water Systems
Water and Wastewater Treatment Design
Advanced Water and Wastes Treatment Processes I
Advanced Water and Wastes Treatment Process II
Industrial Water Quality Management
Engineering Project Design
Development of a Water Project
Topics in Advanced Hydrology
Public Investment Theory and Techniques
Natural Resource Law and Policy
Planning and Water Resources Systems
Special Project in Water Quality Planning
Research in Environmental Sciences and Engineering
Seminar in Environmental Sciences and Engineering
Seminar in Environmental Health
Environmental Health Problems in Developing Countries
Research in Environmental Chemistry
Research in Environmental Biology
Research in Air and Industrial Hygiene
Research in Environmental Management and Protection
Research in Radiological Hygiene
Research in Sanitary Engineering
Research in Water Resources
Master's Thesis

COMMUNITY COLLEGES/TECHNICAL INSTITUTIONS

Wilson County Technical Institute
Wilson, North Carolina

Program: Sanitary Landfill Technology (A.S.)

Hours required for major: Quarter - Major 120
Program Inception: 1976
Staff Size: Two instructors (1 M.A., 1 B.S.)
Enrollment: 15
Graduates (1976): 0
Placement: 0
Graduate Work: 0

Courses

Earth Moving Operations
Dragline I
Blueprint Reading: Civil
Introduction to Solid Waste Disposal
Sanitary Landfill Design
Sanitary Landfill Operation
Introduction to Solid Waste Management
Introduction to Collection Procedures
Introduction to Incineration
Fundamentals of Microbiology
Surveying I
Basic Hydraulics: Principles of Flow
Topographic Drawing
Ecology
Introduction to Physical Geography
Personnel Management
Business Management

State Legislation

NORTH CAROLINA GENERAL

TITLE:

Environmental Policy Act
North Carolina Statutes 113A-1

PURPOSE:

To encourage the productive and beneficial use of the natural resources of the state without environmental damage and to require state agencies to consider and report environmental aspects and consequences of their actions.

DEFINITIONS:

1. Major development project
2. Special-purpose unit of government
3. State agency
4. State official

ADMINISTERING AUTHORITY:

All state agencies

AUTHORIZATIONS:

To report on the environmental impact of all major proposed actions;
To develop alternatives to proposed actions;
To review current regulations and policies to determine consistency with overall state environmental policy.

NORTH CAROLINA AIR/WATER

TITLE:

Water and Air Resources Act
North Carolina Statutes 143-211

PURPOSE:

To provide for the conservation of air and water resources of the state, and to create a department of water and air resources.

DEFINITIONS:

1. Air cleaning device
2. Air contaminant
3. Air contamination
4. Air contamination source
5. Air pollution
6. Area of the state
7. Board
8. Department
9. Discharge of waste
10. Disposal system
11. Effective date
12. Emission
13. Outlet
14. Person
15. Sewer system
16. Standard
17. Treatment works
18. Waste
19. Water pollution
20. Waters
21. Water shed

ADMINISTERING AUTHORITY:

Department of Natural and Economic Resources
Environmental Management Commission

AUTHORIZATIONS:

To identify and classify all water sources of the state;
To develop water quality standards;
To develop a comprehensive air pollution control program;
To engage in air monitoring activities;

AUTHORIZATIONS (Cont'd):

To develop air quality standards;
To develop emission control standards;
To administer a water pollutant discharge permit system;
To administer an air contaminant emission permit system;
To issue pollution abatement orders;
To issue regulation pursuant to the act;
To conduct studies and investigations relating to air and water pollution.

PROHIBITED ACTS:

To cause or allow air or water pollution violation of established quality standards;
To violate the terms of any air or water discharge permit;
To violate any abatement order issued under the act.

NORTH CAROLINA PESTICIDES

TITLE:

Pesticide Law of 1971
North Carolina Statutes 143-434

PURPOSE:

To regulate in the public interest the use, application, sale, disposal and registration of pesticides and to provide for the certification of commercial applicators.

DEFINITIONS:

1. Active ingredient
2. Adulterated
3. Board
4. Commissioner
5. Committee
6. Defoliant
7. Desiccant
8. Device
9. Engage in business
10. Equipment
11. Fungi
12. Fungicide
13. Herbicide
14. Inert ingredient
15. Ingredient statement
16. Insect
17. Insecticide
18. Label
19. Labeling
20. Land
21. Manufacturer
22. Misbranded
23. Nematocide
24. Nematode
25. Person
26. Pest control
27. Consultant
28. Pesticide
29. Pesticide applicator
30. Pesticide dealer
31. Pesticide operator
32. Private regulator
33. Public operator
34. Registrant
35. Restricted use pesticide
36. Rodenticide
37. Weed
38. Wildlife

ADMINISTERING AUTHORITY:

Department of Agriculture
Pesticide Board

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To classify and control pesticide use;
To require the registration of all pesticides;
To license all pesticide dealers;
To establish applicator certification standards;
To certify all commercial pesticide applicators;
To enter and inspect property in enforcement of the act;
To require compliance with label.

CERTIFICATION OR LICENSING:

Pesticide dealers must be licensed;
Applicators must be certified in ground or aerial categories;
Qualifications include two years experience or training;
Examination is required to determine competence and knowledge.

PROHIBITED ACTS:

To distribute, sell, or transport non-registered pesticides;
To engage in pesticide dealer business without license;
To engage in pesticide applicator business without proper certification;
To use any pesticide inconsistent with its label.

EXEMPTIONS:

On registration requirement--common carriers, public officials, and experimental use pesticides;
On certification requirements--farmers.

PENALTIES:

Fines of from $100 to $1,000 or 60 days imprisonment.

NORTH CAROLINA POTABLE WATER

TITLE:

Water and Sewer Sanitation Law
North Carolina Statutes 130-157

PURPOSE:

To promote a safe and healthful environment and to insure the safe quality of public water supplies.

DEFINITIONS:

ADMINISTERING AUTHORITY:

State Board of Health

AUTHORIZATIONS:

To determine the safety of drinking water supplies;
To issue regulations regarding the location and operation of public water facilities;
To approve water supply and sewerage system plans;
To adopt public water supply quality standards;
To require certain water supply treatment techniques.

PROHIBITED ACTS:

To defile any public or private water supply;
To operate any sewage or industrial waste system in an manner as to cause water pollution.

NORTH CAROLINA RADIATION

TITLE:

Radiation Protection Act
North Carolina Statutes 104E

PURPOSE:

Regulate sources of radiation for the protection of public health and safety and to permit development and utilization of radiation sources in a safe manner.

DEFINITIONS:

1. Agreement materials
2. Agreement state
3. Atomic energy
4. By-product material
5. Commission
6. Department
7. Emergency
8. General license
9. Ionizing radiation
10. Non-ionizing radiation
11. Person
12. Radiation
13. Radiation machine
14. Radioactive material
15. Source material
16. Special nuclear material
17. Specific license

ADMINISTERING AUTHORITY:

Department of Human Resources
Radiation Protection Commission

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To require licensing or registration of persons manufacturing, producing or using radioactive material;
To require the safe use and shielding of all source of ionizing radiation;
To undertake an electronic product safety program;

AUTHORIZATIONS (Cont'd)

- To conduct studies and investigations relating to sources of radiation;
- To maintain a statewide environmental radiation monitoring program;
- To issue general or specific licenses to users, manufacturers or producers of radioactive materials;
- To require the maintenance of records relating to radiation;
- To enter into agreements with state and federal agencies;
- To issue emergency radiation orders.

PROHIBITED ACTS:

- To use, manufacture, or produce radioactive materials without proper bond;
- To use, manufacture, or produce sources of radiation without proper license or registration.

EXEMPTIONS:

Individual exemptions can be issued.

PENALTIES:

Violation constitutes a misdemeanor.

NRC AGREEMENT STATE: Yes

NORTH CAROLINA SOLID WASTE

TITLE:

Solid Waste Disposal Law
North Carolina Statutes 130-166

PURPOSE:

To provide for statewide solid waste management and to control solid waste disposal.

DEFINITIONS:

1. Garbage
2. Refuse
3. Solid waste
4. Solid waste disposal
5. Solid waste disposal facility
6. Solid waste disposal site

ADMINISTERING AUTHORITY:

State Board of Health

AUTHORIZATIONS:

To develop a comprehensive program of solid waste disposal and management;
To conduct studies and investigations concerning solid waste disposal program;
To provide standards for solid waste disposal sites and facilities;
To issue regulations pursuant to the act;
To provide assistance in solid waste disposal site development;
To act as a state lead agency for solid waste purposes;
To approve local solid waste disposal facilities.

NORTH CAROLINA WASTE WATER

TITLE:

Oil Pollution Control Act of 1973
North Carolina Statutes 143-215.75

PURPOSE:

To protect the land and waters of the state from pollution by oil and oil products.

DEFINITIONS:

1. Barrel
2. Board
3. Department
4. Director
5. Discharge
6. Environmental Management Commission
7. Having control over act
8. Land
9. Office
10. Oil
11. Oil bailee
12. Oil carrier
13. Oil terminal facility
14. Operator
15. Person
16. Pipeline
17. Restoration
18. Secretary
19. Transfer
20. Vessel
21. Waters

ADMINISTERING AUTHORITY:

Department of Natural and Economic Resources
Environmental Management Commission

AUTHORIZATIONS:

To conduct investigations and studies to enforce the act;
To issue regulations pursuant to the act;
To issue permits for oil and similar discharges;
To supervise the cleanup and removal of any oil discharges;
To cooperate with other state agencies;
To register oil terminal facilities;
To issue permits to oil refining facilities.

PROHIBITED ACTS:

To cause or allow any discharge into waters, tidal flats, beaches, lands or drainage systems of the state;
To fail to undertake discharge removal activities;
To violate the terms of any license or permit.

PENALTIES:

Fines of up to $5,000;
Liability imposed for cleanup expenses and damage to public resources;
Terminal violations - fines of up to $50; refinery violation - fines of up to $10,000.

NORTH CAROLINA WASTE WATER

TITLE:

Sanitarians and Water and Waste Water Treatment Facility Operators Law
North Carolina Statutes 90A

PURPOSE:

To protect the public health and conserve the quality of the water resources of the state, and to provide for the certification of treatment facility operators.

DEFINITIONS:

ADMINISTERING AUTHORITY:

Department of Natural and Economic Resources
Waste Water Treatment Plant Operators Board of Certification
Water Treatment Facility Operators Board of Certification

AUTHORIZATIONS:

To classify water and waste water treatment facilities;
To establish standards of certification;
To certify water and waste water treatment facility operators.

CERTIFICATION OR LICENSING:

All water and waste water treatment facility operators must be certified in a grade corresponding to the facility classification; examination is required to show competency at a particular classification.

PROHIBITED ACTS:

To operate a water or waste water facility without a properly certified operator;
To perform the duties of an operator without proper certification.

Appendix

SANITARY LANDFILL OPERATOR-MANAGER OPTION PROGRAM

WILSON COUNTY TECHNICAL INSTITUTE

Course Title

First Quarter: Earth Moving Operations (Dozer major, Pan minor-required)

Second Quarter: Dragline I

Third Quarter: Reading Improvement or Grammar I and Fundamentals of Mathematics or Technical Mathematics*, Blueprint Reading (Civil) Introduction to Solid Waste Disposal, Sanitary Landfill Operation

Completion of nine month program Operator Certificate Awarded

Fourth Quarter: Communication Skills for Trade & Industry or Composition I*, Technical Mathematics, Topographic Drafting, Introduction to Solid Waste Management, Personnel Management

Completion of twelve month program Diploma Awarded

* Option courses required for two year A.A.S. degree

Fifth Quarter: Technical Reports, Introduction to Physical Geography, Introduction to Incineration, Chemistry, Surveying I

Sixth Quarter: Basic Hydraulics (Principles of Flow), Sanitary Landfill Design, Business Management, Introduction to Biology, Applied Psychology

Seventh Quarter: Introduction to Collection Procedures, Ecology, Fundamentals of Microbiology, Physics (Properties of Matter)

Completion of two year program A.A.S. Degree Awarded

Total Quarter Hours in Courses: 119